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Arizona Corporation Commission

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Arizona Corporation Commission

1200 West Washington Phoenix, Arizona 85007

January 29, 2002

Attention: Nancy Cole, Supervisor Docket Control

Re: Toltec Power Station, L.L.C 10-year Plan(s)

Dear Ms. Cole:

Pursuant to A.R.S. 40-360.02, Toltec Power Station L.L.C. ("Toltec") hereby submits its current 10-year plan for the proposed electric generating station and associated transmission lines which have been the subject of proceedings before the Arizona Power Plant and Transmission Line Sitting Committee("Sitting Committee") and the Commission in Docket No. L-00000Y-01-0112 (Case No.112) and Docket No. L-00000Y-01-0113(Case No. 113).

On December 6, 2001, the Chairman of the Sitting Committee issued recommended form(s) of Decision and Certificate of Environmental Compatibility("CEC") in Case Nos. 112 and 113. Appendix "A" to this letter contains a copy of pages 2 and 3 of the Decision and CEC issued in Case No. 112, which describe the proposed electric generating station facilities which Toltec proposes to construct. Appendix "B" to this letter contains a copy of pages 3 and 4 of the Decision and CEC issued in Case No.113, which describe the 500kv and 345kv transmission facilities associated with the Toltec Power Station. These descriptions are incorporated herein by reference.

<sup>&</sup>lt;sup>1</sup> As indicated in a June 8, 2001 informational filing with the Commission, Toltec will not construct, own or operate these transmission lines. These lines will be owned and operated by a transmission service provider

The recommended form(s) of Decision and CEC are scheduled to be considered by the Commission at an Open Meeting on January 30, 2002. In the event the Commission approves the proposed sitings, Toltec currently anticipates the following commercial in-service operation dates for the Toltec Power Station:

Phase 1 <sup>2</sup> 1st Quarter 2004 Phase 2 1st Quarter 2004 Phase 3 1st Quarter 2005

The anticipated commercial in-service date for the 500kv and 345kv transmission facilities associated with the power station are no later than the first quarter of 2004.

In connection with the proposed transmission facilities, and with reference to A.R.S.40-360.02 (C) (7) and a January 11, 2002 memorandum from the Commission's Utilities Director to Arizona Transmission Providers, attached is a copy of an August 28, 2001 Interconnection Power Flow Update submitted as an exhibit by Toltec in Case Nos. 112 and 113. This supplemented a February 2001 Study, which was also received into evidence.

In the event you have any questions regarding the above and the attached report, or would like additional information, please contact Tom Wray at (602) 808-2004.

Very truly yours,

Lawrence V. Robertson, Jr.

LVR/jm

Cc: Ernest Johnson, Utilities Director Tom Wray, General Manager

L. others S. J. amoreus R

<sup>&</sup>lt;sup>2</sup> Each phase consists of a 600MW (nominal) power block.

#### Appendix A

1	Mark McWhirter	Designee for Director of the Energy Office of Arizona Department of Commerce
2	Richard Tobin	Designee for Director of the Arizona
3	Richard 100m	Department of Environmental Quality
4	Dennis Sundie	Designee for Director of the Arizona Department of Water Resources <sup>1</sup>
5		
6	Patrick Schiffer	Designee for Director of the Arizona Department of Water Resources <sup>1</sup>
7	Jeff McGuire	Appointed Member
8	Mike Palmer	Appointed Member
9	A. Wayne Smith	Appointed Member
10	Sandie Smith	Appointed Member
11	Margaret Trujillo	Appointed Member
12	Mike Whalen	Appointed Member
13	The Applicant was represented by Lawr	rence V. Robertson, Jr. The Arizona Corporation

The Applicant was represented by Lawrence V. Robertson, Jr. The Arizona Corporation Commission ("Commission") staff was represented by Teena Wolfe, DeVinti Williams and David Ronald. Mary-Louise Pasutti, Jon Shumaker and Myra Smith appeared as individual intervenors. Robert S. Lynch appeared on behalf of the Central Arizona Irrigation and Drainage District, Electrical District No. 4, Pinal County, and Electrical District No. 5, Pinal County. Timothy M. Hogan appeared on behalf of the Arizona Center for Law in the Public Interest.

At the conclusion of the public hearings, after consideration of (i) the amended Application and the evidence presented during the public hearings, (ii) the closing arguments of the parties, and (iii) the legal requirements of Arizona Revised Statutes §§ 40-360 through 40-360.13 and A.A.C. R14-3-213, on November 27, 2001, upon motion duly made and seconded, by an 11-0 vote the Committee voted to grant the Applicant the following Certificate.

Applicant is hereby granted a Certificate to site and construct the following facilities ("Project"):

A natural gas fired, combined cycle electric generating plant with an operating capability not to exceed a nominal site rating of 1800 megawatts (MW). The facilities shall consist of up to three (3) power

<sup>&</sup>lt;sup>1</sup> Mr. Sundie served as the indicated designee until September, 2001. Thereafter, Mr. Schiffer succeeded Mr. Sundie in that capacity.

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blocks, each rated up to 600 MW nominal. Each power block shall consist of (i) two combustion turbine generators (CTG), (ii) two heat recovery steam generators (HRSG) and (iii) one steam turbine electric generator. The plant design may also incorporate (i) supplementary or duct-firing of the HRSG and (ii) injecting steam into the CTG for a given power block. The duct-firing design would be incorporated in the HRSG's and the steam injection design would be incorporated in the CTG's. The power plant and supporting infrastructure shall be located in Section 26, Township 9 South, Range 7 East, G&SRB&M.

The supporting power plant infrastructure shall include (i) an air pollution control system, (ii) water handling and treatment facilities, (iii) fuel system, (iv) instrumentation and control system, (v) switchyard and electrical interconnection(s), (vi) chemical and petroleum product storage facilities, (vii) vehicular access facilities, (viii) evaporation ponds, and (ix) other site improvements. Each of these infrastructure components is described in some detail in the amended Application.

In connection with the design and construction of Project facilities, Applicant shall use low profile structures, moderate stacks, neutral colors, compatible landscaping and low intensity directed lighting for the power plant. The transmission facilities shall include the use of non-reflective conductors and towers. In addition, Applicant shall use a zero discharge system for cooling water, subject to existing regulatory requirements. Further, Applicant shall operate the evaporation ponds so that any salt residue(s) contained therein shall not cause damage to crops grown on fields adjacent to the Project site.

This Certificate is further granted upon the following conditions.

- Applicant shall comply with all existing applicable air and water pollution control standards and regulations, and with all existing applicable ordinances, master plans and regulations of the State of Arizona, Pinal County, the United States of America, and any other governmental entities having jurisdiction, including but not limited to the following:
  - A. all applicable zoning stipulations and conditions, including but not limited to landscaping and dust control requirements and/or approvals:
  - B. all applicable air quality control standards, approvals, permit conditions and requirements of the Pinal County Air Quality Control District and/or other State of Arizona or Federal agencies having jurisdiction, and Applicant shall

#### Appendix B

Tucson Electric Power Company. The Arizona Center for Law in the Public Interest also intervened through Timothy M. Hogan.

At the conclusion of the public hearings, after consideration of (i) the Application and the evidence presented during the public hearings, (ii) the closing arguments of the parties, and (iii) the legal requirements of Arizona Revised Statutes §§ 40-360 through 40-360.13 and A.A.C. R14-3-213, on November 27, 2001, upon motion duly made and seconded, by a 9-0 vote the Committee voted to grant the Applicant the following Certificate.<sup>2</sup>

Applicant is hereby granted a Certificate to site and construct the following facilities, as requested in the Application: (i) a 500 kV transmission line which shall interconnect Applicant's Toltec Power Station facilities [Sec.26, T9S, R7E, G&SRB&M] with the Western Systems Coordinating Council ("WSCC") transmission grid at Arizona Public Service Company's ("APS") Saguaro Switchyard [Sec.15, T20S, R10E, G&SRB&M]; and (ii) two (2) 345 kV transmission lines, which shall interconnect the Toltec Power Station facilities with the WSCC transmission grid by means of a "loop in" interconnection with Tucson Electric Power Company's ("TEP") Westwing-South 345 kV transmission lines [Sec.22, T10S, R6E, G&SRB&M]. As testified to by the Applicant during the public hearings, electric power and energy produced at the Toltec Power Station are intended primarily to serve Central and Southern Arizona markets.

The 500 kV transmission line hereby authorized shall originate at Applicant's Toltec Power Station and follow the route proposed by Applicant in its Application for a distance of approximately 19.6 miles to the point of interconnection with APS's Saguaro Swichyard. In that regard, Applicant is further authorized to use a 2000' wide corridor within which it will ultimately acquire up to a 250' wide right-of-way for purposes of siting and construction of the line. Exhibit "A" to this Decision and Certificate sets forth a generalized narrative legal description of the routing hereby approved for the 500 kV transmission line.

The two (2) 345 kV transmission lines hereby authorized shall originate at Applicant's Toltec Power Station and follow the route proposed by Applicant in its Application for a distance of

<sup>&</sup>lt;sup>2</sup>Committee members McWhirter and Schiffer were not present at the time of the vote in Case No. 113.

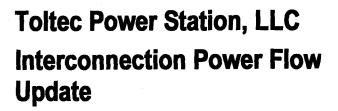
approximately 13.2 miles to the point of "loop-in" interconnection with TEP's Westwing-South 345 kV transmission line. Applicant in that regard is similarly authorized to use a 2000 ' wide corridor within which it shall ultimately acquire up to a 250' wide right-of-way for purposes of siting and construction of the lines, with the exception of the Link 3 portion of the proposed route in which Applicant is authorized to use a one-mile wide corridor [consisting of Secs. 1, 2, 11, 12, 13, 14, 23, and 24 in T10S, R7E, G&SRB&M] in order to provide flexibility for avoiding or mitigating possible archaeological sites. Exhibit "B" to this Decision and Certificate sets forth a generalized narrative legal description of the routing hereby approved for the 345 kV transmission lines. Exhibit "C", as attached hereto, consists of a map depicting the aforementioned 500 kV and 345 kV transmission line corridors.

The authorized single circuit 500 kV transmission line shall be designed and constructed on single-pole or monopole structures, with the exception of lattice towers to span Interstate 10 and the Union Pacific Railroad at the Saguaro switchyard interconnection, if necessary. The authorized double circuit 345 kV transmission lines also shall be designed and constructed on single-pole or monopole structures, with the exception of a lattice structure to complete the interconnection with TEP's Westwing-South 345 kV line. The monopole and lattice tower structures shall consist of dulled galvanized steel, and may range in height from 120' to 165' above grade for the 500 kV transmission line and 140' to 175' above grade for the 345 kV transmission lines, respectively. The conductors shall be non-specular. The spans between the transmission poles shall vary in distance from 600' to 1500' depending upon conductor size, terrain and environmental mitigation conditions at a given location.

The details of the aforementioned interconnections shall be the subject of contractual arrangements to be entered into between the Applicant and APS, and the Applicant and TEP, respectively.

This Certificate is further granted upon the following conditions.

1. Applicant shall comply with all existing applicable air and water pollution control standards and regulations, and with all existing applicable ordinances, master plans



**Toltec Power Station, LLC** 

August 28, 2001



# TOLTEC GENERATION INTERCONNECTION POWER FLOW STUDY UPDATE

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#### A. CONTINGENCY LIST

This report has been prepared for the use of the client for the specific purposes identified in the report. The conclusions, observations and recommendations contained herein attributed to R. W. Beck, Inc. (R. W. Beck) constitute the opinions of R. W. Beck. To the extent that statements, information and opinions provided by the client or others have been used in the preparation of this report, R. W. Beck has relied upon the same to be accurate, and for which no assurances are intended and no representations or warranties are made. R. W. Beck makes no certification and gives no assurances except as explicitly set forth in this report.

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# **EXECUTIVE SUMMARY**

# Introduction

This report summarizes the results of the study to examine the potential impacts on the transmission system of interconnecting the proposed Toltec Power Station ("Client") plant ("Project") to the Arizona transmission grid. The Project is planned as three "two on one" gas combined cycle generating units with duct-firing and steam injection. The Project is to be integrated in two phases with the first phase representing two units or 1200 MW nominal and the second phase adding an additional 600 MW unit for a total of 1800 MW output.

The interconnection examined within this report consists of the output of the GE7FA/Steam turbine combined cycle generating units each stepped-up from the generation voltage to 500 kV, a minimum of two 500/345 kV transformers at the Toltec Power Station breaker-and-a-half switchyard, an approximate twenty mile 500 kV line from the Project switchyard to APS's Saguaro substation, and an approximate thirteen and a half mile in-and-out interconnection to TEP/AEPCO's Westwing – South 345 kV line.

The Base Case is represented by the system which is expected to be in place when the Project comes on-line later in 2003 or first quarter 2004. This includes the Palo Verde – Southwest Valley 500 kV line addition and associated regional system modifications as modeled in the WSCC 2001 series power flow case model. Additionally, generating plants that are currently under construction are included in the Base Case for the 1200 MW output level and SRP's Santan plant expansion is added to the Base Case for the 1800 MW Project output level.

As a sensitivity, the loop in of the Cholla to Saguaro 500 kV line at Silverking is also examined. This network upgrade has been discussed under the Central Area Transmission Study group ("CATS") as a possible, potentially low cost, means of increasing power delivery to the East Valley. While a second sensitivity was considered, an evaluation of the system with the "announced" SRP new transmission line project that would connect Palo Verde to somewhere in the East Valley, there were not enough details available to model this alternative. In regards to the tentative route the following was excepted from the August 15 Arizona Republic under the title "SRP plans major line for Valley." "While the precise path of the line has yet to be determined, it would generally run from western Maricopa County to a point southeast in Pinal County. From there a smaller 130-kV line would run 15 to 20 miles to a substation on Signal Butte between Elliot and Guadalupe roads." Although the February 28, 2001 Toltec Power Station Transmission Interconnection Study Executive Summary as filed with the Toltec Power Station CEC application provided a sensitivity regarding the certificated Palo Verde to Saguaro 500 kV line, the most recent information available provides no indication that this proposed line will actually



### **Executive Summary**

interconnection with Saguaro 500 kV Substation. Given these significant unknowns, this sensitivity was not re-examined as part of this update.

The results of this study are not intended to project how the Project "will" interconnect, but instead present how the Project "may" interconnect to the existing system while providing coordination, where possible, with future transmission plans that are often subject to change. The actual interconnection will be based on coordinated efforts between Toltec Power Station, LLC and the host utility(ies) as well as other interested parties.

# **Project Description**

The following lists the Project assumptions used in the analyses.

Project Name:

**Toltec Power Station** 

Maximum Summer Capability (MW):

1200 & 1800

Interconnection Voltage:

500 and 345 kV

Interconnection Location:

Approximately 20 miles from the Saguaro 500 kV substation

13.5 miles from Westwing - South 345 kV line

Host Transmission Utility:

APS and TEP

Reliability Council/RTO:

WSCC/Desert Star

Plant Configuration:

Up to three 2 on 1 GE7FA/Steram turbine gas-fired combined cycle units with duct firing

# **Local Market Assessment Summary**

In addition to evaluating the impact of integration of the Project on power flows in the region, it is also important, when siting new generation, to evaluate how a proposed resource may meet the projected resource needs of the region. Although the load and resource balance of the entire Arizona region is a consideration, the ability to serve regional load pockets, e.g., the East Valley and Tucson markets, is a significant consideration applicable to the Project site. This consideration applies both to the interconnection and the resource capacity in the region.

The Toltec Project site is located on the southern edge of the AZ-EV zone. Details pertaining to this zone are provided below.

## **AZ-EV Zone**

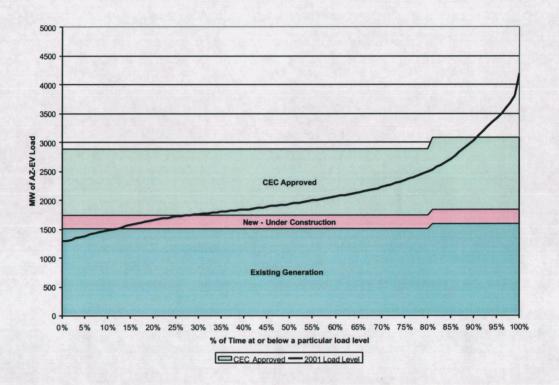
The East Valley zone includes the fast growing East Valley region (e.g., Tempe, Mesa, Chandler) of the Phoenix metropolitan area as well as Coolidge and down to Saguaro generating station. Utilities within the zone primarily include SRP, APS, WAPA, Mesa Electric Utility, San Carlos Irrigation Project and several Electrical/Irrigation Districts.

The zone has an existing deficiency in generation. This deficiency would turn to a surplus if all planned generation were constructed.

The following figure shows the level of existing, under construction and CEC approved generation plotted against the 2001 load duration curve (inclusive of reserve margin) for the zone. It is noted that much of this generation is not even yet under construction, let alone

operating. With the exception of the applied forced and maintenance outage rate, the generation level shown assumes no retirements and that the full output level of the units (as shown above in the generation summary table) is available on-peak.

#### **AZ-EV ZONE RESOURCE CAPACITY**



Even with the operating Desert Basin plant (included with the existing generation) and the under construction Kyrene expansion (shown marked as New – Under Construction), the zone will have to import power to serve zone load over 70% of the time, and at peak, close to its import limit of approximately 2500 MW.

The following tables provide a summary of the projected load and resource balance for the zone from 2001 to 2008. New generation plants that are under construction are included in the Base while in addition new generation plants with CEC approval or a CEC application filed are included in the Stress.

#### **AZ-EV BASE**

AZ-EV	New Gen Capacity (MW)	2001	2002	2003	2004	2005	2006	<u> 2007</u>	2008
WSCC Growth - 2.5%									
Peak Demand - MW		3747	3841	3937	4035	4136	4239	4345	4454
Historical Growth - 5.2%									
Peak Demand - MW		3747	3942	4147	4362	4589	4828	5079	5343
Resources:									
Hydro		223	223	223	223	223	223	223	223
ST Coal/Gas		315	315	315	315	315	315	315	315
CC (New)		540	540	540	540	540	540	540	540
CC (Old)		307	307	307	307	307	307	307	307
CT Gas/Oil (Old)		267	267	267	267	267	267	267	267
New Generation:									
SRP Kyrene (AZ11)	250	0	250	250	250	250	250	250	250
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New Resources Added		0	250	250	250	250	250	250	250
Total Resources		1652	1902	1902	1902	1902	1902	1902	1902
2.5% Growth									
12% Reserve Margin - MW		450	461	472	484	496	509	521	534
Surplus(Deficit) - MW		(2545)	(2400)	(2507)	(2617)	(2730)	(2846)	(2965)	(3086)
% of Peak Demand		-68%	-62%	-64%	-65%	-66%	-67%	-68%	-69%
5.2% Growth									
12% Reserve Margin - MW		450	473	498	523	551	579	609	641
Surplus(Deficit) - MW		(2545)	(2513)	(2742)	(2984)	(3238)	(3505)	(3786)	(4082)
% of Peak Demand		-68%	-64%	-66%	-68%	-71%	-73%	-75%	-76%

Projecting the load levels from the current levels demonstrates how the Toltec Project, in conjunction with the already approved Santan plant, scheduled to come on-line by 2005 summer peak, and the Sundance peaking project, shows there would still be a deficiency assuming the historical growth rate. Additionally, the graph does not factor in the use restrictions of the older Kyrene units or those that may apply to Santan. Even thought the total capacity increase added for these two units is 976 MW (250 for Kyrene plus 726 MW for Santan), operating restriction may in reality only result in a net increase in the order of 400 MW. This would result in lowering the level of existing generation by over 500 MW. This reduction is not shown in the following table nor is the fact that almost 900 MW of the gas/oil generation in the zone (including the Kyrene and Santan units that may be operationally limited per CEC) will be 30 years or older by 2003 and 315 MW of this same generation will be over 40 years old by 2005.

#### **AZ-EV STRESS**

AZ-EV	New Gen Capacity (MW)	2001	2002	2003	<u> 2004</u>	2005	2006	2007	2008
WSCC Growth - 2.5%		0747	2044	0007	4035	4136	4239	4345	4454
Peak Demand - MW Historical Growth - 5.2%		3747	3841	3937	4035	4130	4239	4340	4404
Peak Demand - MW		3747	3942	4147	4362	4589	4828	5079	5343
Resources:		3141	3342	4141	4302	4308	7020	3018	3343
Hydro		223	223	223	223	223	223	223	223
ST Coal/Gas		315	315	315	315	315	315	315	315
CC (New)		540	540	540	540	540	540	540	540
CC (New)		307	307	307	307	307	307	307	307
CT Gas/Oil (Old)		267	267	267	267	267	267	267	267
01 043/011 (014)		201	,	20.	,	20.	-0.		
New Generation:									
SRP Kyrene (AZ11)	250	0	250	250	250	250	250	250	250
SRP Santan (AZ12)	726	0	0	0	0	726	726	726	726
PP&L Sundance (AZ16)	540	0	0	540	540	540	540	540	540
SPG Toltec Phase I (AZ13)	1160	0	0	0	1200	1200	1200	1200	1200
SPG Toltec Phase II (AZ13)	580	0	0	0	0	600	600	600	600
New Resources Added		0	250	790	1990	3316	3316	3316	3316
Total Resources		1652	1902	2442	3642	4968	4968	4968	4968
2.5% Growth									
12% Reserve Margin - MW		450	461	472	484	496	509	521	534
Surplus(Deficit) - MW		(2545)	(2400)	(1967)	(877)	336	220	101	(20)
% of Peak Demand		-68%	-62%	-50%	-22%	8%	5%	2%	0%
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5.2% Growth									
12% Reserve Margin - MW		450	473	498	523	551	579	609	641
Surplus(Deficit) - MW		(2545)	(2513)	(2202)	(1244)	(172)	(439)	(720)	(1016)
% of Peak Demand		-68%	-64%	-53%	-29%	-4%	-9%	-14%	-19%

# **Case Development**

The Base Case was created from the FERC-715 Filing 2001 Series WSCC Summer Peak Case. The selected case included the Palo Verde to Southwest Valley 500 kV line and associated 230 kV modifications. The WSCC case also included WAPA's announced system modification of the Phoenix WAPA – Lone Butte – Santa Rosa from its current operating level of 115 kV to its designed operating level of 230 kV. However, based on new information from WAPA, this operational modification was removed from the Base Case, resulting in a return to how the facility currently operates at the 115 kV level.

# **New Generation Projects in Base Case**

The Base Case includes all generation project in Arizona currently under construction. Additionally, SRP's Santan plant expansion was assumed in-service for the full output of the Project planned by summer peak of 2005.

# **Transaction Scenarios**

Toltec has identified it primary target market as Arizona. As such, the transaction schedules shown in Table 2 were simulated in the load flow case models. For each Alternative, the

## **Executive Summary**

transactions were simulated in two separate ways, first by proportionately scaling Arizona load and second by proportionally reducing Arizona generation. While neither of these will be completely reflective of actual transactions, the combination of the two helps to identify which overloads are caused or partially caused by load growth and which may attributable to integration of the Project. This methodology also provides a representative evaluation of impacts on the system prior to specific transmission service receipt and delivery points being specified.

Table 2 **Transaction Schedules in MW** 

Region	"Alt 1&2 A"	"Alt 1&2 B"	"Alt 3&4 A"	"Alt 3&4 B"		
 	Load Scale	Gen Scale	Load Scale	Gen Scale		
Arizona	1200	1200	1800	1800		

# **Results**

The study indicates that under normal condition, integration of the Project results in no new loading violations (not attributable to load growth) for either a 1200 or an 1800 MW Project output with or without the Silverking connection.

Additionally, the post contingency results without the Silverking interconnection indicate that the Project can deliver approximately 1200 MW to the grid. To integrate the 1800 MW Project without the Silverking connection, regional 115 kV upgrades, system modification or implementation of operating schemes could be necessary. While the loading on the Cholla transformer is well within 125% of normal rating, loading on the Westwing 500/345 kV transformer may require a remedial action scheme or other system modification. A loading violation also occurs on the Westwing to Toltec to South lines. However, the emergency rating of this line appears limited by path rating as opposed to thermal capability of a double bundled 954 ACSR constructed line. As such, the rating may possibly be increased with a demonstration of increased flow. Additionally, the "announced" second Westwing – South 345 kV line included in TEP's 10-year plan would presumably alleviate these two violation.

The addition of the Silverking connection to the model alleviates all but the Westwing 500/345 kV transformer and the Westwing – South 345 kV line overloads as discussed in the previous paragraph.

In addition to the impacts identified previously, integration of the Project has several positive impact on system flows. For example, integration of the Project reduces flow on the Kyrene transformers. Additionally, integration of the Project appears to better balance delivery of power to the Tucson system. It increases the flow into Tucson at both Tortolita and South potentially providing more flexibility in regards to future system modifications.

# **Section 1**

## INTRODUCTION AND METHODOLOGY

# Introduction

This report summarizes the results of the study to examine the potential impacts on the transmission system of interconnecting the proposed Toltec Power Station ("Client") plant ("Project") to the Arizona transmission grid. The Project is planned as three "two on one" gas combined cycle generating units with duct-firing and steam injection. The Project is to be integrated in two phases with the first phase representing two units or 1200 MW nominal and the second phase adding an additional 600 MW unit for a total of 1800 MW output.

# **Purpose of Study**

Previous to this report, Beck examined several various interconnection alternatives. The purpose of these initial simulations was to (1) perform a preliminary assessment of the performance of various interconnection scenarios and (2) narrow the selection of interconnection alternatives to those which may be feasible, based primarily on the need for potential system upgrades to interconnect the Project at specific output levels of 1000, 1500 and 2000 MW which represented up to four "two on one" 500 MW combined cycle generating units.

The interconnection examined within this report consists of the output of the GE7FA/Steam turbine combined cycle generating units each stepped-up from the generation voltage to 500 kV, a minimum of two 500/345 kV transformers at the Toltec Power Station breaker-and-a-half switchyard, an approximate twenty mile 500 kV line from the Project switchyard to APS's Saguaro substation, and an approximate thirteen and a half mile in-and-out interconnection to TEP/AEPCO's Westwing – South 345 kV line.

The Base Case is represented by the system which is expected to be in place when the Project comes on-line later in 2003 or first quarter 2004. This includes the Palo Verde – Southwest Valley 500 kV line addition and associated regional system modifications as modeled in the WSCC 2001 series power flow case model. Additionally, generating plants that are currently under construction are included in the Base Case for the 1200 MW output level and SRP's Santan plant expansion is added to the Base Case for the 1800 MW Project output level.

As a sensitivity, the loop in of the Cholla to Saguaro 500 kV line at Silverking is also examined. This network upgrade has been discussed under the Central Area Transmission Study group ("CATS") as a possible, potentially low cost, means of increasing power delivery to the East Valley. While a second sensitivity was considered, an evaluation of the



system with the "announced" SRP new transmission line project that would connect Palo Verde to somewhere in the East Valley, there were not enough details available to model this alternative. In regards to the tentative route the following was excepted from the August 15 Arizona Republic under the title "SRP plans major line for Valley." "While the precise path of the line has yet to be determined, it would generally run from western Maricopa County to a point southeast in Pinal County. From there a smaller 130-kV line would run 15 to 20 miles to a substation on Signal Butte between Elliot and Guadalupe roads." Although the February 28, 2001 Toltec Power Station Transmission Interconnection Study Executive Summary as filed with the Toltec Power Station CEC application provided a sensitivity regarding the certificated Palo Verde to Saguaro 500 kV line, the most recent information available provides no indication that this proposed line will actually interconnection with Saguaro 500 kV Substation. Given these significant unknowns, this sensitivity was not re-examined as part of this update.

The results of this study are not intended to project how the Project "will" interconnect, but instead present how the Project "may" interconnect to the existing system while providing coordination, where possible, with future transmission plans that are often subject to change. The actual interconnection will be based on coordinated efforts between Toltec Power Station, LLC and the host utility(ies) as well as other interested parties.

The study uses "N-1" contingency load flow analyses in examining the potential impact of integration of the Project on the transmission system. To examine the effects (i.e., power flow changes) of adding generation, it is common practice to use power flow analyses to compare power flows on the transmission system with and without the added generation. It is important, however, when performing power flow comparisons, to recognize the difference between "typical" effects and "detrimental" effects on an AC transmission grid.

Where the power flow analysis may identify facilities that are loaded beyond the applicable facility ratings defined in the load flow case model, whether or not the facility requires upgrade to interconnect the Project to the system and/or acquire transmission service from the Project will be dependent on specific utility criteria.

Additionally, the results are based on the assumptions used in creating the power flow case model(s). Therefore, it is necessary to not only document the assumptions used but to evaluate a series of cases based on reasonable assumptions. The assumptions used for the analyses, discussed herein, are in line with common utility practices. However, the study is not intended to reflect detailed design of generation and system modification assumed for the purpose of the study, nor does it assess operational issues associated with the day to day operation of the power grid.

# **Characteristics of AC Transmission Grid**

Recognizing the difference between typical and detrimental effects requires an understanding of certain characteristics of an AC transmission system. In particular, there are two important characteristics of AC transmission that are relevant to this understanding. The first is that, for any given configuration of generators, power is delivered from generation to

load in precisely the most efficient manner possible. Sometimes, this inherent and beneficial feature is referred to as "taking the path of least resistance." A second characteristic of AC transmission is that, when a circuit goes off-line unexpectedly (i.e., trips), power transfers automatically and instantaneously to parallel circuits on the grid. This capability greatly enhances the reliability of interconnected transmission grids.

These beneficial characteristics come with a consequence, namely that power flowing over AC transmission systems obeys the laws of physics and, therefore, follow the "paths of least resistance" without regard for ownership or corporate boundaries. Thus, on an integrated transmission, all generators will have an effect on the entire transmission grid and not just the transmission system to which they are interconnected. Moreover, the effects of generators on adjacent systems is dynamic, in that actual power flows on the transmission system are continually changing as generation is dispatched to serve load that changes hour-by-hour throughout each day and throughout the year.

When using a power flow program to evaluate the transmission system, it must be remembered that each power flow case represents only a single snapshot in time; i.e., an assumed load level, VAr schedule, system configuration and generation dispatch to serve the load at one instant in time. Evaluating potential impacts of the Project means adding new generation to an original configuration or "base case" and requires that a corresponding amount of existing generation be removed or reduced (or alternately, load increased) in order to maintain the necessary load and resource balance. The potential impacts of the changed case or "change case" are evaluated by comparing it to the "base case". When the "change case" is compared to the "base case", power flows on the system will be observed to change. Such changes are neither positive nor negative in and of themselves and, instead, may simply be indicative of normal operating changes which the transmission grid was designed to accommodate.

# **Project Description**

The following lists the Project assumptions used in the analyses.

Project Name:

Toltec Power Station

Maximum Summer Capability (MW):

1200 & 1800

Interconnection Voltage:

500 and 345 kV

Interconnection Location:

Approximately 20 miles from the Saguaro 500 kV substation

13.5 miles from Westwing - South 345 kV line

Host Transmission Utility:

APS and TEP

Reliability Council/RTO: Plant Configuration:

WSCC/Desert Star

Up to three 2 on 1 GE7FA/Steram turbine gas-fired combined cycle units with duct firing

The interconnection consists of the output of the GE7FA/Steam turbine combined cycle generating units each stepped-up from the generation voltage to 500 kV, a minimum of two 500/345 kV transformers at the Toltec Power Station breaker-and-a-half switchyard, an approximate twenty mile 500 kV line from the Project switchyard to Saguaro substation,

and an approximate thirteen and a half mile in-and-out interconnection to the Westwing – South 345 kV line.

The Project is planned as three "two on one" gas combined cycle generating units with duct-firing and steam injection. The Project is to be integrated in two phases with the first phase representing two units or 1200 MW output and the second phase adding an additional 600 MW unit for a total of 1800 MW output.

 Alternatives 1 and 3 – The interconnection as described with no additional system modifications.

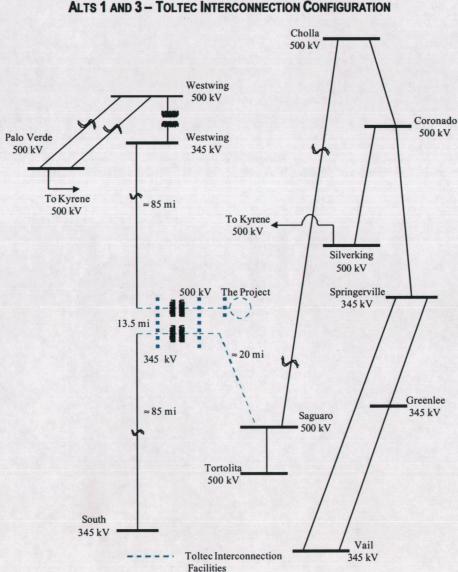


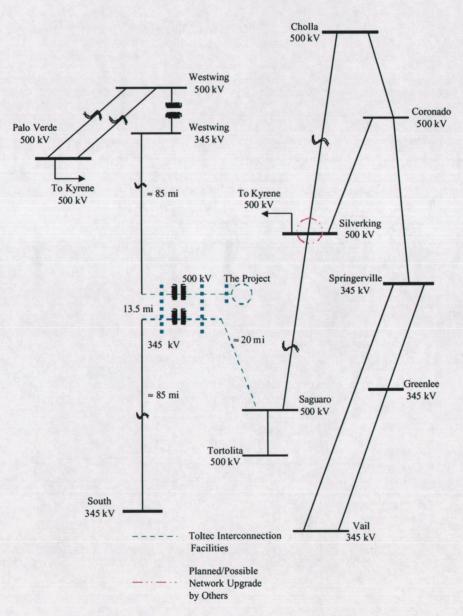
FIGURE 1A

ALTS 1 AND 3 – TOLTEC INTERCONNECTION CONFIGURATION

• Alternatives 2 and 4 – The interconnection as described plus a bulk transmission system configuration change where the existing Cholla – Saguaro 500 kV line is rerouted a short distance to connect via an in-and-out tap to the existing Silverking 500 kV substation prior to terminating at Saguaro. The configuration change will permit deliveries of power from the Saguaro area directly into the eastern side of the East Valley without having to contractually deliver either over the 230 kV network or first to Cholla and then back to Silverking via Coronado.

FIGURE 1B

ALTS 2 AND 4 — TOLTEC INTERCONNECTION CONFIGURATION



# "N-1" Analysis Goals and Methodology

The goal of the Load Flow "N-1" Contingency Analysis is to perform an evaluation of the incremental impact of the Project on the loading of the regional transmission system. To achieve this goal, Beck uses the following process:

- 1. Examine level and location of existing and planned generation in the vicinity of the Project.
- A Base Case is developed to establish a baseline performance of the system before the Project. The Base Case may include other proposed generating project or transmission system additions/modifications in the region.
- 3. "Change" Case(s) are then developed which include the Project.
- 4. Single contingency ("N-1") analysis is then performed on each scenario.
- 5. Results from the change case(s) are compared to the results from the Base Case to evaluate the incremental impact of the Project on the loading of the transmission system.
- The results are analyzed and presented.

Beck uses General Electric's PSLF program to run the load flow cases.

The results of the analyses may not reflect (i) operating limitations and (ii) loading violations that result from different assumptions used to create the cases. Additionally, the analysis "forces" the plant to be dispatched and therefore does not reflect the competitive aspects of the Project. The purpose of the analyses is to identify transmission facilities that have the potential to limit the dispatch of the Project and/or other generators in the local region under heavy load conditions (when power is most needed to serve load). Whether or not upgrade of the facilities is required for integration of the Project will depend on many factors such as the local utilities Generation Interconnection procedures.

The interconnection/deliverability studies are typically performed using summer peak load cases. A peak load "N-1" analysis adheres to what has traditionally been considered good utility practice. The analyses are used to demonstrate the ability to serve load under heavy load conditions when flexibility of generation resource dispatch is reduced. For a more rigorous system impact or integration study, light load (approx. 40-50%) and "shoulder" load (approx. 60-70%) load flow cases may also be evaluated.

In addition, studies other than the load flow analysis (e.g., stability and/or short circuit analysis) will frequently be performed as part of a System Impact or Facilities Study, to fully measure the impact of the Project on the interconnected power system.

# **Section 2**

## **MARKET BACKGROUND**

## **Market Structure**

The structure of the market will play a major role in many factors that will affect the operation, expansion and liquidity of the market (e.g., how congestion is managed, how transmission expansion costs are allocated).

With the exception of California, the west has not yet transitioned to Regional Transmission Organizations ("RTO's") or even tightly operated pools. Although filings have been made in that regard (specifically Desert Star and RTO-West), progress has been slow. As with other regions of the country, the Arizona system is composed of many different utility systems that have integrated transmission facilities. The Project is located southeast of Phoenix and will interconnect with the Arizona Public Service ("APS") and Tucson Electric Power ("TEP") systems, which in turn connects to many of the surrounding systems. In an integrated AC transmission network changes on one system will affect power flows on another. In that regard, coordinated planning is performed across regions as opposed to only examination of a single company in isolation.

While planning for regions has generally been coordinated by the NERC Regional Reliability Councils (e.g., WSCC, SERC, MAPP, MAIN), the council regions divisions are blurring with the FERC directed establishment of RTOs, given that participants of several established reliability councils are splitting between different RTOs.

Organizations applicable to this region in particular are:

- The Federal Energy Regulatory Commission ("FERC").
- The Western Systems Coordinating Council (WSCC)
- Desert Star
- RTO West

# **Organizational Entities**

The WSCC territory covers all the western states including western Canada.

All public utilities (except those participating in an approved regional transmission entity that conforms to the Commission's RTO principles) that own, operate or control interstate transmission facilities were required to file with the Commission by October 15, 2000 a proposal for an RTO with the minimum characteristics and functions adopted in the Final



Rule, or, alternatively, a description of efforts to participate in an RTO, any existing obstacles to RTO participation, and any plans to work toward RTO participation.

#### FERC RTO's

FERC has taken several steps in re-emphasizing its position on the development of large, independent, transmission organizations in order to fulfill the goals outlined in Order No. 888. Steps include the May 1999 notice of proposed rulemaking (NOPR), the subsequent FERC Order 2000, and several precedent setting orders to individual utility or RTO/ISO filings.

The Commission identifies the following minimum characteristics and functions that must be met in order to qualify as an RTO.

- Independence from market participants;
- Appropriate scope and regional configuration;
- Possession of operational authority for all transmission facilities under the RTO's control; and
- Exclusive authority to maintain short-term reliability.

Seven Minimum Functions an RTO must perform:

- 1. Administer its own tariff and employ a transmission pricing system that will promote efficient use and expansion of transmission and generation facilities;
- 2. Create market mechanisms to manage transmission congestion;
- 3. Develop and implement procedures to address parallel path flow issues;
- 4. Serve as a supplier of last resort for all ancillary services required in Order No. 888 and subsequent orders;
- 5. Operate a single OASIS site for all transmission facilities under its control with responsibility for independently calculating TTC and ATC;
- 6. Monitor markets to identify design flaws and market power; and
- 7. Plan and coordinate necessary transmission additions and upgrades.

#### **Desert STAR**

The following is the December 28, 2000 FERC Compliance filing (Docket No. RTO1-44-000) filed reporting on the status of Desert Star:

"On October 16, in Arizona Public Service Co. Docket No. RO1-44-000, Desert STAR, Inc., ("Desert STAR") together with six utilities subject to the Commission's jurisdiction —Arizona Public Company, El Paso Electric Company, Public Service Company of Colorado, Public Service Company of New Mexico, Texas-New Mexico Power Company and Tucson Electric Power Company (the "Jurisdictional Utilities")—filed a detailed report on their efforts to establish a Regional Transmission Organization ("RTO") ("October 16 Filing"). The RTO is expected to encompass all or portions of Arizona, New Mexico, Colorado, Eastern Wyoming and West Texas.

Numerous issues have been resolved. Others remain, not the least of which is the development of a suitable transmission rate design. The task is especially difficult in light of the fact that approximately one-half of the transmission facilities in the region are owned by entities, such as Federal power marketing administrations, tax-exempt utilities and cooperatives, that are not subject to the Commission's jurisdiction. Moreover, the current transmission rates differ markedly among the various entities. The jurisdictional Utilities and Salt River Project Agricultural Improvement & Power District ("Salt River Project") made a transmission rate design proposal and are working with non-jurisdictional transmission owners (such as Western Area Power Administration, Tri-State Generation and Transmission Association, Southwest Transmission Cooperative, Inc. and Colorado Springs Utilities) to further develop and refine the proposal for presentation to the stakeholders and Board of Directors. Other issues remain to be resolved.

The stakeholders are continuing to develop the documentation that will be necessary for a more complete and better developed filing. The utilization of a collaborative process involving substantial stakeholders input should produce a better end product, with fewer issues to be resolved by the Commission, but such process is necessarily time-consuming."

#### **RTO West**

On October 16, 2000, Nevada Power, along with eight other utilities and market participants, filed with FERC to form a regional transmission organization named RTO West. The nine members of RTO West are Avista, BPA, Idaho Power, Montana Power, Nevada Power, PacificCorp, Portland General; Electric, Puget Sound Energy and Sierra Pacific.

As proposed, RTO West will operate the transmission systems for all participating transmission owners located in Washington, Oregon, Idaho, Nevada, Utah, and parts of Montana, Wyoming and California.

In addition to the RTO West FERC Filing, six of the utilities have taken an additional step toward formation of an independent for profit transmission company, TransConnect. The new transmission company would own or lease the high voltage transmission facilities currently held by Avista Corp., Montana Power Company, Portland General Electric, Puget Sound Energy, Nevada Power Company, and Sierra Pacific Power Company.

## **Transmission Interconnection Requirements**

Transmission Interconnection requirements can vary from utility to utility. FERC Order 888 outlined equal access to transmission service but did not address the ability to interconnect to a utility's transmission system without requesting firm transmission service. As such, many utilities required that a firm transmission request be submitted under their OASIS rules in order to interconnect new generation. FERC precedence, however, has provided for two distinct types of service, i.) Interconnection Service and ii.) Transmission Service. This is an

important consideration and distinction - Interconnection Service allows the facility addition to interconnect to the power system, but does not grant the right to transmit power to the ultimate consumers (deliverability). In order to obtain the right to transfer power to the ultimate consumer, Transmission Service needs to be procured. Most transmission providers limit non-Load Serving Entities (LSE's) to Point to Point Transmission Service, and therefore, a merchant generation developer must also specify a Point of Delivery, or "sink" when requesting Transmission Service.

The initial step of the response by the host to both the transmission service and/or interconnection request is a study, if required, completed at the expense of the requestor. In regards to the Project, Interconnection requests have been filed with both TEP and APS.

In addition to electrical interconnection requirements, merchant power providers will require significant interface with local regulatory bodies.

# **Regional Background**

The Project is located within the southwestern WSCC region, southeast of Phoenix, Arizona. The Extra High Voltage ("EHV") transmission system in the region includes 500 kV, 345 kV, and 230 kV.

### Infrastructure and Constraints

The predominant flow of power in Arizona is across the East of the River path ("EOR") to the west into California and from the north and northeast in Arizona into the Phoenix and Tucson load zones. As such flow to the Arizona markets is constrained from the Four Corners region, the Navajo plant and the Cholla plant into Phoenix. Additionally, as new plants are constructed around Palo Verde, studies have shown (as described in the July 2001 Revised Biennial Transmission Assessment) that delivery from this hub will become more congested in regards to delivery into the Arizona markets.

Several potentially limited transmission paths affecting Arizona are included in the WSCC Path Rating Catalog and are shown on the Figure below.

# Substations (kV) ●1,000 to 1,000 500 to 500 345 to 345 230 to 230 Transmission Lines (kV) 230 -500 -1,000 North Yuma ost Canyon Durango Hesperus Southwest of NM<sub>2</sub> Four Corners •Ojo West Mesa DC Tie to Cholla to Pinnacle NM1 **EOR** DC Tie to

#### **WSCC RATED TRANSMISSION "PATHS"**

Several Paths identified on the figure above are described below.

Path #	Path Description	Rating (MW)
22	Southwest of Four Corners	2325 (East – West)
47	Southern New Mexico (NM1)	925 (S) <sup>1</sup> 1048 (NS) <sup>2</sup>
48	Northern New Mexico (NM2)	1450 - 1692
49	East of the River (EOR)	7550 (East – West) Not rated (West – East)
50	Cholla to Pinnacle Peak	1200 (East – West)

# **Regional Generation**

Dispatch of generation in the region of the Project affects the results of the analyses. The following table shows existing Arizona Utilities' generation presented in an approximated economic dispatch order based on filed FERC Form 1 data.

Table 1
Summary of Existing Regional Generation

 			·		Cap		Net	Total	Maximum
		Prime		Year(s)	Factor		Generation	Production	Capability
Ownership	Plant Name	Mover	Prime Fuel	Bullt	(%)	# of Units	(MWh)	\$/MWh	(MW)
 Jointly	Palo Verde	NU	Nuclear	1986-88	92.0	3	13970770	18.21	3810
TEP	Springerville	ST	Coal	1985/90	87.6	2	5829792	32.56	760
Jointly	Four Corners	ST	Coal	1970	82.1	5	3478408	12.56	2060
Jointly	San Juan	ST	Coal	1973/82	81.1	2	5329445	23.26	1798
Jointly	Navajo	ST	Coal	1974/76	65.8	3	10581100	16.38	2415
SRP	Stewart Mt.	HY	Hydro	1929	61.4	1	33565	27.81	13
AEPCO	Apache	ST	Coal/Gas	1964/79	54.0	3	UNK	UNK	425
APS	Cholla	ST	Coal	1962/81	51.7	4	3845135	20.11	995
WAPA	Parker – Davis	HY	Hydro	1951	48.8	5	UNK	UNK	366
SRP	Coronado	ST	Coal	1979/80	46.4	2	5039392	25.24	736
WAPA	Glen Canyon	HY	Hydro	1964/66	39.1	8	UNK	UNK	1304
SRP	Roosevelt	HY	Hydro	1972	31.5	1	70299	26	34
TEP	Irvington	ST	Coal/Gas	1967	29.9	4	1104485	45.7	425
SRP	Mormon Flat	HY	Hydro	1920/71	27.3	2	109749	15.18	51
APS	West Phoenix CC	CC	Gas (Old)	1976	27.0	3	602590	36.09	285
SRP	Agua Fria	ST	Gas/Oil (Old)	1961	24.6	3	888092	32.86	386
SRP	Horse Mesa	HY	Hydro	1927/72	24.4	4	207372	16.75	125
APS	Ocotillo	ST	Gas	1960	15.9		319380	45.43	230
APS	Saguaro	ST	Gas/Oil	1955	9.7	2	178262	46.47	209
SRP	Santan	CC	Gas (Old)	1974-5	9.7	4	714062	35.11	307
SRP	Kyrene	ST	Gas/Oil	1954	5.4	2	50072	76.48	106
APS	West Phoenix	GT	Gas	1973	5.2	3	50903	53.92	284
APS	Ocotillo	GT	Gas	1972-3	3.4		33501	62.81	187
APS	Saguaro GT	GT	Gas/Oil (Old)	1973	2.7	2	26142	65.35	109
SRP	Agua Fria GT	GT	Gas	1975	2.2	3	42223	196.66	226
APS	Yucca	GT	Gas/Oil (Old)	1971-4	2.0	5	25551	63.14	223
AEPCO	Apache CT	GT	Gas/Oil (Old)	1975	1.2	2	UNK	UNK	130
SRP	Kyrene GT	GT	Gas/Oil (Old)	1973	1.2	3	18990	75.2	158
TEP	Irvington GT	GT	Gas/Oil (Old)	1973	8.0	2	5161	72.68	60
TEP	North Loop	GT	Gas/Oil (Old)	1973	0.7	5	5631	70.64	310
TEP	DeMoss Petrie	GT	Gas/Oil (Old)	1973/2001	0.1	1	569	441.7	130
District Owned	New Waddell	HY	Hydro	1993	UNK	4	UNK	UNK	46
Non-utility	Yuma	CC	Gas (Old)	1994	UNK	1	UNK	UNK	56
AEPCO	Apache CC	CC	Gas (Old)	1963	NA	2	UNK	UNK	30
UNK	Vail CT	UNK	Gas/Oil (Old)	UNK	NA	1	UNK	UNK	130

# **Proposed Regional Generation**

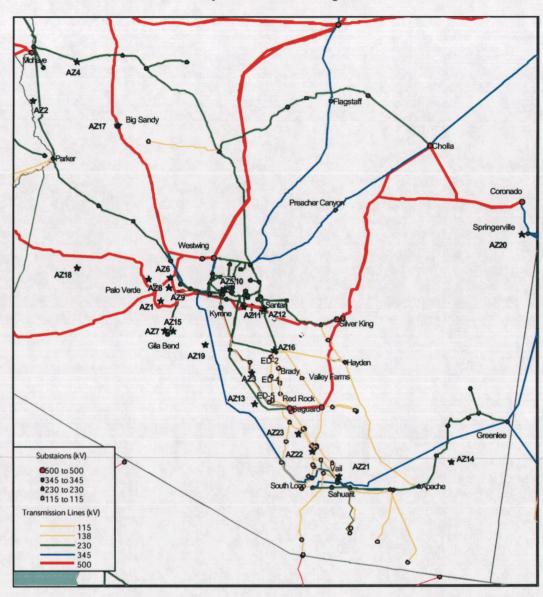
Since dispatch of other generating resources affects power flows in the region, it may be necessary to add some level of "new" generation to the Base Case. As such, the following table lists proposed generation in the region and that which has been selected to include in the Base Case model.

## **Proposed Generation Table**

#	Developer	Plant Name	Location	State	Summer MW	ISDN	Comments
AZ1	Duke Energy Power Services	Arlington Valley	SW of Buckeye	AZ	500	2002	Under Construction
AZ2	Calpine Mojave	South Point	Bullhead City	AZ	520	2001	Operating
AZ3	Reliant Energy Power Gen	Desert Basin	Casa Grande	AZ	540	2001	Operating
AZ4	Griffith Energy/Duke/PPL	Griffith	Kingman	AZ	650	2001	Operating
AZ5	Arizona Public Service Co.	West Phoenix	West Phoenix	AZ	130	2001	Operating
AZ6a	Pinnacle West Energy	Red Hawk	Palo Verde	AZ	1000	2002	Under Construction
AZ6b	Pinnacle West Energy	Red Hawk	Palo Verde	AZ	1000	2006	CEC Approval
AZ7a	Panda Energy International	Gila River	Gila River	AZ	1000	2003	Under Construction
AZ7b	Panda Energy International	Gila River	Gila River	AZ	1000	2004	CEC Approval
AZ8	PG&E Generating	Harquahala	Harquahala	AZ	1000	2003	Under Construction
AZ9	Sempra Energy Resources	Mesquite	Near Palo Verde	AZ	1000	2003	Under Construction
AZ10	Pinnacle West / Calpine	43rd Avenue	West Phoenix	AZ	525	2003	CEC Approval
AZ11	Salt River Project	Kyrene	Kyrene	AZ	240	2002	Under Construction
AZ12	Salt River Project	Santan	Santan (Gilbert)	AZ	726	2005	CEC Approval
AZ13a	Toltec Power Station, LLC.	Toltec Power Station	Eloy (Toltec)	AZ	1200	2003	CEC Pending
AZ13b	Toltec Power Station, LLC.	Toltec Power Station	Eloy (Toltec)	AZ	600	2004	CEC Pending
AZ14	Bowie Power Station, LLC.	<b>Bowie Power Station</b>	Bowie	AZ	1000	2004	CEC filed on July 27, 2001
AZ15	Gila Bend Power Partners	Gila Bend	Gila Bend	AZ	750	2003	CEC approval
AZ16	PP&L	PPL Sundance Energy	Coolidge	AZ	540	2002	CEC approval (80%)- Peaking unit
AZ17	Caithness Big Sandy LLC		Wikieup	AZ	720	2002	CEC Pending
AZ18	Allegheny Energy Supply Co	La Paz	La Paz Co.	AZ	1080	2005	Status of CEC unknown
AZ19	AES	Montezuma Energy	Mobile	AZ	520	2003?	Status of CEC unknown
AZ20a	Unisource/Bechtel	Springerville	Springerville	AZ	380	2004	ACC Approval in 1977
AZ20b	Unisource/Bechtel	Springerville	Springerville	AZ	380	2005	ACC Conditional Approval in 1987 Updated Application Filed
AZ21	Tucson Electric Power Co	Vail Generating Station	Rita Ranch	AZ	150	2002	Peaking
AZ22	Tucson Electric Power Co	DeMoss Petrie	DeMoss Petrie	AZ	75	2002	Peaking
AZ23	Tucson Electric Power Co	North Loop	North Loop	AZ	21	2002	Peaking

Darker Highlight	Indicates the plant was already modeled in the WSCC Summer Peak Case
Lighter Highlight	Indicates the plant was modeled in the Base Case and may or may not be dispatched
No Highlight	Indicates the plant was not added to the Base Case

The following figure provides a geographic representation of the proposed and planned generation plants.



#### **Proposed Generation Figure**

# **Local Market Assessment Summary**

In addition to evaluating the impact of integration of the Project on power flows in the region, it is also important, when siting new generation, to evaluate how a proposed resource may meet the projected resource needs of the region. Although the load and resource balance of the entire Arizona region is a consideration, the ability to serve regional load pockets, e.g., the East Valley and Tucson markets, is a significant consideration applicable to the Project site. This consideration applies both to the interconnection, discussed previously, and the resource capacity in the region.

Based on a number of factors including, but not limited to, the existing location of generation, load and announced generation, Beck has separated the target areas into the Load Zones described in the following table.

#### **ARIZONA LOAD/RESOURCE ZONES**

NAME	GENERAL LOCATION	COMMENTS
AZ-N	Northern and Eastern AZ	Heavy generation area; includes coal plant in northeastern and eastern Arizona.
AZ-Phx	AZ-Phx Phoenix, Arizona  AZ-Phx East Valley (Arizona)  Z-S:Tuc Southeast Arizona including Tucson  Western Arizona (Yuma/Parker)  NM-N Northern New Mexico  NM-S Southern New Mexico  NM-S Las Vegas, Nevada	Zone covers the Phoenix region generally north of I-10 up to Prescott north of Phoenix. The Load Zone also includes the Palo Verde area generation.
AZ-EV	East Valley (Arizona)	The East Valley has experienced constraints in delivering power to the area. SRP has a large portion of the load within the zone and the major delivery points are Kyrene, Coronado to Silver King and Saguaro 500 kV ties.
AZ-S:Tuc	Southeast Arizona including Tucson	The area of Arizona southeast of Saguaro and south of Greenlee experiences existing constraints in importing power mainly into Tucson. As such, there is existing "must-run" generation in the zone.
AZ-W		The Yuma area has only a small amount of existing generation, but likewise does not have a large amount of load. This region is, however, in the major corridor from Palo Verde to San Diego and has experienced regional transmission constraints. The northern portion of the Zone has less load (mainly Lake Havasu,, Kingman), and two new generating plants, Griffiths and Southpoint.
NM-N	Northern New Mexico	The area primarily consists of Public Service of New Mexico ("PNM") load in Albuquerque.
NM-S	Southern New Mexico	This area is primarily El Paso Electric's ("EPE") service territory. This is not expected to be a primary market for new Arizona generation.
NV-LV	Las Vegas, Nevada	The Las Vegas region has strong ties to both Arizona and Southern California.
SoCal	Southern California	Arizona transmission could face congestion tied to deliveries to the Southern California market.

These zones are shown graphically on the following figure.

#### Substations (kV) ●500 to 500 ●345 to 345 •230 to 230 Transmission Lines (kV) 230 345 NV-I.V 500 Crysta Corners A7.-N NM-N **NEW MEXICO** SoCal DC Tie to SPS AZ-Phx AZ-W AZ-EV NM-S SPS AZ-S:Tuc DC Tie to SPS

#### LOAD/RESOURCE ZONES

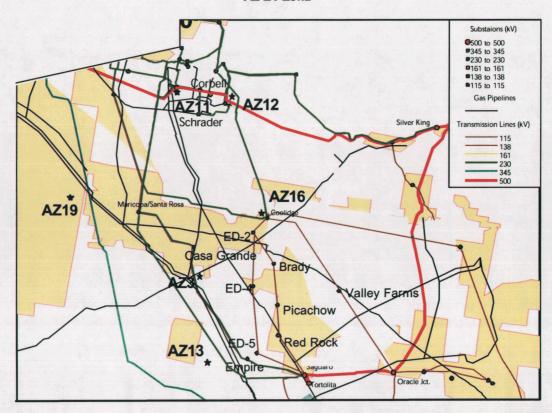
The Toltec Project site is located on the southern edge of the AZ-EV zone. Details pertaining to this zone are provided below.

## **AZ-EV Zone**

The East Valley zone includes the fast growing East Valley region (e.g., Tempe, Mesa, Chandler) of the Phoenix metropolitan area as well as Coolidge and down to Saguaro generating station. Utilities within the zone primarily include SRP, APS, WAPA, Mesa Electric Utility, San Carlos Irrigation Project and several Electrical/Irrigation Districts.

The zone has an existing deficiency in generation. This deficiency would turn to a surplus if all planned generation were constructed.

#### AZ-EV ZONE



The following table lists the existing and the proposed generation in the East Valley region. The table is divided into sections representing the status of the various units. The top of the list contains existing plants, that were for this region put into operation between 1920 and 1975. While the oldest units are Hydro plants, the fossil fuel plants began operation as early as 1955 and as late as 1975. There is also one new 540 MW combined cycle generating unit that came on-line in 2001.

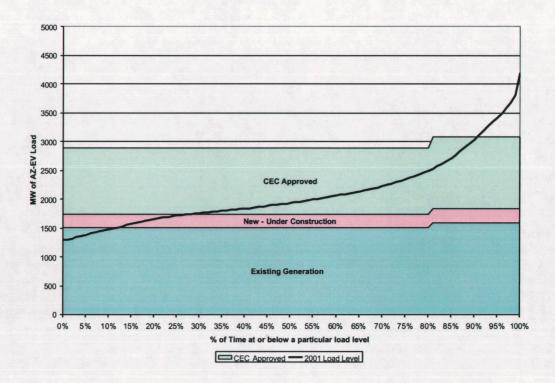
#### Section 2

Plant Name	Cap Factor (%)	# of Units	Fuel Type	Year(s) Built/ ISD	Net Generation (MWh)	Total Prod (\$/MWh)	Maximum Capability (MW)	Ownership
Stewart Mt.	61.44	1	Hydro	1929	33,565	27.81	13	SRP
Roosevelt	31.47	1	Hydro	1972	70,299	26	34	SRP
Mormon Flat	27.26	2	Hydro	1920/71	109,749	15.18	51	SRP
Horse Mesa	24.41	4	Hydro	1927/72	207,372	16.75	125	SRP
Saguaro	9.74	2	ST Gas/Oil	1955	178,262	46.47	209	APS
Santan	9.69	4	CC (Old)	1974-5	714,062	35.11	307	SRP
Kyrene	5.39	2	ST Gas/Oil	1954	50,072	76.48	106	SRP
Saguaro GT	2.71	2	CT Gas/Oil (Old)	1973	26,142	65.35	109	APS
Kyrene GT	1.18	3	CT Gas/Oil (Old)	1973	18,990	75.2	158	SRP
Desert Basin (AZ3)	New/IO	3	CC (New)	2001		-	540	Reliant
Kyrene (AZ11)	New/UC	2	CC (New)	2002	-	-	250	SRP
Santan (AZ12)	New/CEC	4	CC (New)	2005	-	-	726	SRP
PPL Sundance Energy (AZ16)	New/CEC	1	CC (New)	2003	-	•	540	PP&L
Toltec Power Station Phase I (AZ13)	New/PEN	2	CC (New)	2003	_	-	1200	Toltec
Toltec Power Station Phase II (AZ13)	New/PEN	1	CC (New)	2004	-	-	600	Toltec
Mobile (AZ19)	New/PLN	1	CC (New)	2003	-	-	520	AES
Total							5488	

IO - In operation UC - Under construction CEC - CEC Approval PEN - CEC Pending FLD - CEC Filed PLN - Planned

The following figure shows the level of existing, under construction and CEC approved generation plotted against the 2001 load duration curve (inclusive of reserve margin) for the zone. It is noted that much of this generation is not even yet under construction, let alone operating. With the exception of the applied forced and maintenance outage rate, the generation level shown assumes no retirements and that the full output level of the units (as shown above in the generation summary table) is available on-peak.

#### **AZ-EV ZONE RESOURCE CAPACITY**



Even with the operating Desert Basin plant (included with the existing generation) and the under construction Kyrene expansion (shown marked as New – Under Construction), the zone will have to import power to serve zone load over 70% of the time, and at peak, close to its import limit of approximately 2500 MW.

The following tables provide a summary of the projected load and resource balance for the zone from 2001 to 2008. New generation plants that are under construction are included in the Base while in addition new generation plants with CEC approval or a CEC application filed are included in the Stress.

#### **AZ-EV BASE**

AZ-EV	New Gen Capacity (MW)	2001	2002	2003	2004	<u>2005</u>	2006	2007	2008
WSCC Growth - 2.5%									
Peak Demand - MW		3747	3841	3937	4035	4136	4239	4345	4454
Historical Growth - 5.2%									
Peak Demand - MW		3747	3942	4147	4362	4589	4828	5079	5343
Resources:									
Hydro		223	223	223	223	223	223	223	223
ST Coal/Gas		315	315	315	315	315	315	315	315
CC (New)		540	540	540	540	540	540	540	540
CC (Old)		307	307	307	307	307	307	307	307
CT Gas/Oil (Old)		267	267	267	267	267	267	267	267
New Generation:									
SRP Kyrene (AZ11)	250	0	250	250	250	250	250	250	250
SRP Santan (AZ12)	726	0	0	0	0	0	0	0	0
PP&L Sundance (AZ16)	540	0	0	0	0	0	. 0	0	0
SPG Tottec Phase I (AZ13)	1160	0	0	0	0	0	0	. 0	0
SPG Tollec Phase II (AZ13)	580	0	0	0	0	0	0	0	0
New Resources Added		0	250	250	250	250	250	250	250
Total Resources		1652	1902	1902	1902	1902	1902	1902	1902
2.5% Growth									
12% Reserve Margin - MW		450	461	472	484	496	509	521	534
Surplus(Deficit) - MW		(2545)	(2400)	(2507)	(2617)	(2730)	(2846)	(2965)	(3086)
% of Peak Demand		-68%	-62%	-64%	-65%	-66%	-67%	-68%	-69%
								-	
5.2% Growth									
12% Reserve Margin - MW		450	473	498	523	551	579	609	641
Surplus(Deficit) - MW		(2545)	(2513)	(2742)	(2984)	(3238)	(3505)	(3786)	(4082)
% of Peak Demand		-68%	-64%	-66%	-68%	-71%	-73%	-75%	-76%

Projecting the load levels from the current levels demonstrates how the Toltec Project, in conjunction with the already approved Santan plant, scheduled to come on-line by 2005 summer peak, and the Sundance peaking project, shows there would still be a deficiency assuming the historical growth rate. Additionally, the graph does not factor in the use restrictions of the older Kyrene units or those that may apply to Santan. Even thought the total capacity increase added for these two units is 976 MW (250 for Kyrene plus 726 MW for Santan), operating restriction may in reality only result in a net increase in the order of 400 MW. This would result in lowering the level of existing generation by over 500 MW. This reduction is not shown in the following table nor is the fact that almost 900 MW of the gas/oil generation in the zone (including the Kyrene and Santan units that may be operationally limited per CEC) will be 30 years or older by 2003 and 315 MW of this same generation will be over 40 years old by 2005.

#### **AZ-EV STRESS**

	New Gen Capacity								
AZ-EV	(MW)	2001	2002	2003	2004	2005	2006	2007	2008
WSCC Growth - 2.5%									
Peak Demand - MW		3747	3841	3937	4035	4136	4239	4345	4454
Historical Growth - 5.2%									
Peak Demand - MW		3747	3942	4147	4362	4589	4828	5079	5343
Resources:									
Hydro		223	223	223	223	223	223	223	223
ST Coal/Gas		315	315	315	315	315	315	315	315
CC (New)		540	540	540	540	540	540	540	540
CC (Old)		307	307	307	307	307	307	307	307
CT Gas/Oil (Old)		267	267	267	267	267	267	267	267
New Generation:									
SRP Kyrene (AZ11)	250	0	250	250	250	250	250	250	250
SRP Santan (AZ12)	726	0	0	0	0	726	726	726	726
PP&L Sundance (AZ16)	540	0	0	540	540	540	540	540	540
SPG Toitec Phase I (AZ13)	1160	0	0	0	1200	1200	1200	1200	1200
SPG Toltec Phase II (AZ13)	580	0	0	0	0	600	600	600	600
New Resources Added		0	250	790	1990	3316	3316	3316	3316
Total Resources		1652	1902	2442	3642	4968	4968	4968	4968
2.5% Growth									
12% Reserve Margin - MW		450	461	472	484	496	509	521	534
Surplus(Deficit) - MW		(2545)	(2400)	(1967)	(877)	336	220	101	(20)
% of Peak Demand		-68%	-62%	-50%	-22%	8%	5%	2%	0%
5.2% Growth									
12% Reserve Margin - MW		450	473	498	523	551	579	609	641
Surplus(Deficit) - MW		(2545)	(2513)	(2202)	(1244)	(172)	(439)	(720)	(1016)
% of Peak Demand		-68%	-64%	-53%	-29%	-4%	-9%	-14%	-19%
						.,•			

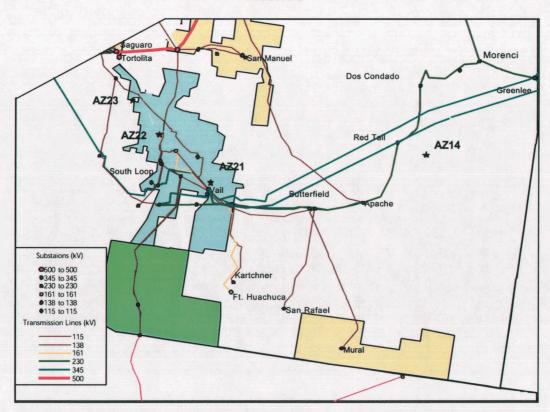
#### **AZ-S: TUC Zone**

This zone covering southeastern Arizona has, at it center, the city of Tucson. The Toltec Project interconnection has a tie directly to this zone via its 345 kV Westwing to South connection.

Utilities within the zone primarily include TEP, AEPCO (including member Coops), Citizens Utilities, Thatcher Municpal Utilities, Morenci Water and Electric Company and Electrical/Irrigation Districts.

The Tucson zone has a large number of older gas/oil generating units and few megawatts of announced new plants within the zone. However, TEP has announced and expansion of its coal-fired Springerville generating station and an associated new transmission line addition from Springerville to Greenlee. This power would be delivered along with the existing Springerville plant into the Tucson system at Vail. There has also been some talk of a line to Mexico from this zone, which, if constructed, would increase the need for generation within or import capability into the zone.

#### AZ-S:TUC

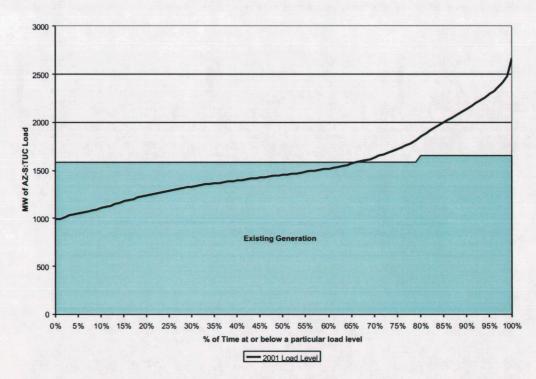


The following table lists the existing generation and the proposed new generation in the region. The table is divided into sections representing the status of the various units. The top of the list contains existing plants, that were for this region put into operation between 1964 and 1990. Within the City of Tucson load area of the zone, there are fossil fuel plants that began operation as early as 1955 and as late as 1973. Additionally two plant expansions totaling 96 MW were placed in operation in 2001.

Plant Name	Cap Factor (%)	# of Units	Fuel Type	Year(s) Built/ ISD	Net Generation (MWh)	Total Prod (\$/MWh)	Maximum Capability (MW)	Ownership
Apache ST	54.04	3	ST Coal/Gas	1964/79	NA	NA	425	AEPCO
Irvington	29.88	4	ST Coal/Gas	1967	1,104,485	45.7	425	TEP
Apache CT	1.23	2	CT Gas/Oil (Old)	1963/75	NA	NA	30	AEPCO
Irvington GT	0.81	2	CT Gas/Oil (Old)	1973	5,161	72.68	60	TEP
North Loop	0.68	5	CT Gas/Oil (Old)	1973	5,631	70.64	310	TEP
DeMoss Petrie	0.14	1	CT Gas/Oil (Old)	1973	569	441.7	130	TEP
Apache CC	NA	2	CC (Old)	1964	NA	NA	140	AEPCO
Vail CT	NA	1	CT Gas/Oil (Old)	NA	NA	NA	130	NA
DeMoss Petrie (New) (AZ22)	New/IO	1	CT Gas	2001			75	TEP
North Loop (New) (AZ23)	New/IO	1	CT Gas	2001			21	Millenium
Bowie Power Station (AZ14)	New/FLD	2	CC (New)	2004		-	1000	Bowie
Vail Generating Station (AZ21)	New/PLN	1	CT Gas	2002			150	TEP
Total							2926	

IO - In operation UC - Under construction CEC - CEC Approval PEN - CEC Pending FLD - CEC Filed PLN - Planned

The following figure shows the level of existing, under construction and CEC approved generation plotted against the load duration curve (inclusive of reserve margin) for the zone.



**AZ-S: TUC ZONE RESOURCE CAPACITY** 

The load in the zone must be served a majority of the time with older higher cost generation or via imports from Springville and other units.

The following tables provide a summary of the projected load and resource balance for the zone from 2001 to 2008. New generation plants that are under construction are included in the Base while in addition new generation plants with CEC approval or a CEC application filed are included in the Stress.

#### **AZ-S:TUC BASE**

AZ - S: TUC	New Gen Capacity (MW)	2001	2002	2003	2004	2005	2006	2007	2008
WSCC Growth - 2.5%									
Peak Demand - MW		2387	2447	2508	2571	2635	2701	2768	2837
Historical Growth - 3.7%									
Peak Demand - MW		2387	2475	2567	2662	2760	2863	2968	3078
Resources:									
ST Coal/Gas		850	850	850	850	850	850	850	850
CC (Old)		140	140	140	140	140	140	140	140
CT Gas		96	96	96	96	96	96	96	96
CT Gas/Oil (Old)		660	660	660	660	660	660	660	660
New Generation:									
SPG Bonia (AZFA) vai Ch (XZ21)	1900 190	0	0	, Q , 0	- B - O	9	0	Ô	e e
New Resources Added		0	0	0	0	0	0	0	0
Total Resources		1746	1746	1746	1746	1746	1746	1746	1746
2.5% Growth									
12% Reserve Margin - MW		286	294	301	308	316	324	332	340
Surplus(Deficit) - MW		(927)	(994)	(1063)	(1133)	(1205)	(1279)	(1354)	(1432)
% of Peak Demand		-39%	-41%	-42%	-44%	-46%	-47%	-49%	-50%
3.7% Growth									
12% Reserve Margin - MW		286	297	308	319	331	344	356	369
Surplus(Deficit) - MW		(927)	(1026)	(1129)	(1235)	(1346)	(1460)	(1579)	(1702)
% of Peak Demand		-39%	-41%	-44%	-46%	-49%	-51%	-53%	-55%

#### **AZ-S:TUC STRESS**

	New Gen Capacity								
AZ - S: TUC	(MW)	2001	2002	2003	<u> 2004</u>	2005	2006	2007	2008
WSCC Growth - 2.5%									
Peak Demand - MW		2387	2447	2508	2571	2635	2701	2768	2837
Historical Growth - 3.7%									
Peak Demand - MW		2387	2475	2567	2662	2760	2863	2968	3078
Resources:									
ST Coal/Gas		850	850	850	850	850	850	850	850
CC (Old)		140	140	140	140	140	140	140	140
CT Gas		96	96	96	96	96	96	96	96
CT Gas/Oil (Old)		660	660	660	660	660	660	660	660
New Generation:									
SPG Bowie (AZ14)	1000	0	0	0	1000	1000	1000	1000	1000
Vail CT (AZ21)	150	0	0	150	150	150	150	150	150
New Resources Added		0	0	150	1150	1150	1150	1150	1150
Total Resources		1746	1746	1896	2896	2896	2896	2896	2896
2.5% Growth									
12% Reserve Margin - MW		286	294	301	308	316	324	332	340
Surplus(Deficit) - MW		(927)	(994)	(913)	17	(55)	(129)	(204)	(282)
% of Peak Demand		-39%	-41%	-36%	1%	-2%	-5%	-7%	-10%
3.7% Growth									
12% Reserve Margin - MW		286	297	308	319	331	344	356	369
Surplus(Deficit) - MW		(927)	(1026)	(979)	(85)	(196)	(310)	(429)	(552)
% of Peak Demand		-39%	-41%	-38%	-3%	-7%	-11%	-14%	-18%

# **Section 3**

## CASE DEVELOPMENT AND ASSUMPTIONS

As with all load flow analyses, the results of the study are driven by the assumptions used in developing the load flow case. To minimize the impact of these assumptions, Beck starts the process with a publicly filed load flow case model and then details the changes made to the model in evaluating the Project.

# **Case Development**

The Base Case was created from the FERC-715 Filing 2001 Series WSCC Summer Peak Case., The case was acquired from the CAISO site, but had no changes to Arizona load or generation from the filed WSCC case. The Arizona load level was assumed to be reflective of the 2001 time frame based on peak load data. The WSCC cases are filed with FERC as part of the annual 715 filing requirement. Beck relies upon these load flow models but does not independently verify all of the data in the models.

The selected case included the Palo Verde to Southwest Valley 500 kV line and associated 230 kV modifications. The WSCC case also included WAPA's announced system modification of the Phoenix WAPA – Lone Butte – Santa Rosa from its current operating level of 115 kV to its designed operating level of 230 kV. However, based on new information from WAPA, this operational modification was removed from the Base Case, resulting in a return to how the facility currently operates at the 115 kV level.

The Base Case is then used to create the Change Case(s) by adding the Project. For generating project additions, the generation is re-dispatched to accommodate the generation addition(s). The method used to re-dispatch the generation and a table showing the modifications to the dispatch are shown under Dispatch Assumptions.

The cases developed for this analysis are described below:

- ♦ Base Case WSCC Summer Peak load flow case modified to include proposed generation in the region with a dispatch as shown in Table 3.
- ♦ Alternative 1 Proposed interconnection with Project at 1200 MW.
- Alternative 2 Same as Alternative 1 with Silverking modification.
- ♦ Alternative 3 Proposed interconnection with project at the 1800 MW.
- ◆ Alternative 4 Same as Alternative 3 with Silverking modification.

While a detailed line design would be required for Alternatives 2 and 4, for the purpose of this analyses, it was assumed that the series compensation, currently existing on the Cholla –



Saguaro 500 kV line, would be relocated from Cholla to Silverking so that the modeling of the Cholla to Silverking 500 kV line more closely matches that of the Coronado to Silverking. The modeled Saguaro to Silverking connection will permit deliveries of power from the Saguaro area directly into the west side of the East Valley without having to contractually schedule over the 230 and/or 115 kV regional system or to Silverking via Cholla and Coronado.

# **New Generation Projects in Base Case**

The dispatch of generation in a region impacts transmission system power flows. While it is not possible to evaluate all possible operational impacts, for planning purposes, it is necessary to assume a certain level of generation to meet the projected load. In this regard, assumptions need to be made as to which new generation projects should be included in the Base Case model used.

The Base Case includes all generation project in Arizona currently under construction. Additionally, SRP's Santan plant expansion was assumed in-service for the full output of the Project planned by summer peak of 2005.

- 1. The Duke Energy Arlington Valley plant modeled at 500 MW and dispatched at 498 MW (added to the Base Case)
- 2. The Calpine Southpoint plant modeled at 520 MW and dispatched at 420 MW (already in the Base Case)
- 3. The Reliant Desert Basin plant modeled at 540 MW and dispatched at 460 MW (already in the Base Case)
- 4. The Griffith Energy modeled at 650 MW and dispatched at 540 MW (already in the Base Case)
- 5. The Pinnacle West Red Hawk plant modeled at 1000 MW and dispatched at 873 MW (added to the Base Case)
- 6. The Panda Gila River plant modeled at 1000 MW and dispatched at 873 MW (added to the Base Case)
- 7. The PG&E Harquahala plant modeled at 1000 MW and dispatched at 873 MW (added to the Base Case)
- 8. The Sempra Mesquite plant modeled at 1000 MW and dispatched at 873 MW (added to the Base Case)
- 9. The Pinnacle West/Calpine 43<sup>rd</sup> Avenue (West Phoenix) plant modeled at 525 MW and dispatched at 480 MW (already in the Base Case)
- 10. The Kyrene expansion modeled at 240 MW and dispatched at 240 MW (already in the Base Case)
- 11. The Santan expansion modeled at 726 MW and dispatched at 726 MW for the 1800 MW Project output

- 12. The TEP DeMoss Petrie expansion modeled at 75 MW and dispatched at 75 MW (added to the Base Case)
- 13. The TEP North Loop expansion modeled at 21 MW and dispatched at 21 MW (added to the Base Case)

#### **Transaction Scenarios**

Toltec has identified it primary target market as Arizona. As such, the transaction schedules shown in Table 2 were simulated in the load flow case models. For each Alternative, the transactions were simulated in two separate ways, first by proportionately scaling Arizona load and second by proportionally reducing Arizona generation. While neither of these will be completely reflective of actual transactions, the combination of the two helps to identify which overloads are caused or partially caused by load growth and which may attributable to integration of the Project. This methodology also provides a representative evaluation of impacts on the system prior to specific transmission service receipt and delivery points being specified.

Table 2
Transaction Schedules in MW

Region	"Alt 1&2 A"	"Alt 1&2 B"	"Alt 3&4 A"	"Alt 3&4 B"
	Load Scale	Gen Scale	Load Scale	Gen Scale
Arizona	1200	1200	1800	1800

# **Dispatch Assumptions**

Generation is adjusted to accommodate other new generation projects assumed in the study to create the Base Case. Generation is further adjusted to accommodate the proposed Project to create the Change Case(s).

Table 3 shows the generation dispatch used to simulate the transactions for the analysis for each dispatch level.

Table 3 Generation Dispatch and Area Interchange Summary

777			Ger	eration Dispa	tch Modific	ations (MW	)	
Area: Generating Units (Bus #)	Capacity	WSCC	Dana	Base		Alternative	Scenarios	
Area. Generating Units (Bus #)	Factor		Base Case	Case w/	Alt	Alt	Alt	Alt
		Case	Case	Santan	1&2 A	1&2 B	384 A	384 B
AZ: Palo Verde (14931-3)	92.00%	4186	3810	3810	3810	3810	3810	3810
AZ: Aqua Fria (15901-3)	24.60%	281	386	25	386	386	25	25
AZ: Ocotillo (14924-5)	15.90%	230	230	150	230	230	150	150
AZ: Santan (19521,4)	9.69%	134	285	0	285	285	0	0
AZ: Apache CT (17024-7)	1.23%	158	158	158	158	158	158	158
AZ: Apache ST (17028-30)	54.04%	425	425	425	425	425	425	425
AZ: North Loop CT (16510,5-6)	0.68%	205	205	205	205	205	205	205
AZ: Irvington CT (16504)	0.81%	50	0	0	50	50	50	50
AZ: Vail CT (16517)	NA	130	0	0	130	130	130	130
AZ: Irvington GT (16503,7-9)	29.88%	415	415	415	415	415	415	415
LADWP: Haynes (26026-31)	4.03%	1530	1305	1305	1305	1305	1305	1305
PG&E: Morro Bay (36408-10)	18.04%	725	0	0	0	0	0	0
SCE Scaled Load	NA	0	-550	-550	-550	-550	-550	-550
SDGE Scaled Load	NA	0	-758	-758	-758	-758	-758	-758
NM: Person	NA	220	140	140	140	140	140	140
NM: Scaled Load	NA	0	-420	-420	-420	-420	-420	-420
WAPALC: Griffith (19311-3)	NA	540	540	540	540	540	540	540
WAPALC: Southpoint (19317-9)	NA	420	420	420	420	420	420	420
AZ: AZ Load Scale	NA	0	0	0	-1200	0	-1800	0
AZ: AZ Gen Scale	NA	0	0	0	0	-1200	0	-1800
AZ: Red Hawk (14974-85)	NA	886	873	873	873	873	873	873
AZ: Santan (15926-7)	NA	726	0	726	0	0	726	726
AZ: Desert Basin (14501-3)	NA	460	460	460	460	460	460	460
AZ: West Phoenix (14966-8)	NA	300	480	480	300	300	300	300
AZ: Kyrene (15918)	NA	240	240	240	240	240	240	240
AZ: Gila River (90001-12)	NA	0	873	873	873	873	873	873
AZ: Sempra (79221-6)	NA	0	873	873	873	873	873	873
AZ: Harquahala (79201-4)	NA	0	873	873	873	873	873	873
AZ: Arlington Valley (79206-16)	NA	0	498	498	498	498	498	498
NM: Luna	NA	0	500	500	500	500	500	500
AZ: Toltec (93000)	NA	0	0	0	1200	1200	1800	1800
Total Dispatched (Selected units)			12261	12261	12261	12261	12261	12261
Change in Area Interchange								
AZ			0	2258	2258	2258	2258	2258
SCE			0	-550	-550	-550	-550	-550
SDGE			0	-758	-758	-758	-758	-758
LADWP			0	-225	-225	-225	-225	-225
PG&E			0	-725	-725	-725	-725	-725

# **Contingencies Evaluated**

Beck evaluated the system for single contingency (N-1) outages as identified in Appendix A.

For the Base Case and the Alternatives, Beck monitored flows and voltages on Arizona facilities.

# **Evaluation Criteria**

Criteria are necessary to evaluate the performance of the transmission system within this analysis. This section describes the applicable criteria used for evaluation in this analysis.

WSCC, under their Reliability Criteria for Transmission System Planning, requires its members to comply with standards set forth by the organization. WSCC, however, acknowledges the need for planning criteria to reflect "practical considerations such as the geography, type of load being served, system configuration, weather, local acceptance, or political and regulatory oversight." Therefore, the organization believes each individual member's planning criteria should "complement the reliability of the Western Interconnection with the practical needs of each individual system" and states "each individual system may use its internally applied reliability criteria to plan its internal system" as long as they meet WSCC criteria.

The following evaluation criteria are used for the analysis:

- During normal operation (e.g., prior to any contingency), line and transformer loading should not exceed the specified Normal Rating ("N" or Rating 1 within the load flow case).
- During contingency operation, line and transformer loading should not exceed the specified Emergency Rating ("E" or Rating 2 in the load flow case). Some Arizona systems supply only one rating or set the Normal Rating and the Emergency Rating equal to each other. For these, it is possible that the emergency rating could be assumed to be 110% of the Normal rating value.

The results of the contingency analyses for the Change Case(s) are compared with the Base Case loadings for the same contingency to determine if integration of the Project resulted in any new overloads. The Results section details the overloads occurring in the change case(s) both with and without contingencies.

# **Section 4**

#### RESULTS

There are several considerations when examining the impact of a particular project on the grid. Discussed within this section is the impact on facilities where the loading exceeds the rating of the facility. Loading violations such as these may indicate that (1) transmission system upgrades are necessary, (2) special protection schemes need to be implemented in conjunction with the Project, (3) other system configuration change(s) is(are) warranted or (4) that staging of integration of various output levels of the Project requires coordination with future transmission expansion plans.

The power flow analysis results have two key components, an AC analysis to identify facilities that are overloaded at maximum output and a Linear, DC, analysis which projects the Project output level at which loading violation occurs ("FCITC"). In conjunction with these results are the presentation of the transaction distribution factors ("TDF") of the Project on these same facilities.

Both Normal and Outage Conditions are presented in separate tables.

#### Table description:

Column 1: FCITC, i.e., First Contingency Incremental Transfer Capability (This

column identifies the level of Project dispatch for which the applicable overload element occurs. Negative FCITC numbers represent pre-

existing Base Case loading violations.)

Column 2: TDF, i.e., Normal "N" or Outage "O" Transaction Distribution Factor

(The percent of the transaction that flows over the element under either normal or outage conditions. Positive and negative denotes the

direction of flow on the facility.)

Column 3: Type "Tp" (Designation of overloaded element as either a line "L" or

transformer "X".)

Column 4: Overloaded Element (Element that overloads for the identified

contingency. The value identified in the FCITC column corresponds to

the Project output level at which this overload may occur.)

Column 5: Area (Area designation of the overloaded element)

Column 6: Contingency (Outage resulting in the overloaded element. This includes

"No Outage" for all lines in service.)

Column 7: Rating (Normal/Emergency rating of the overloaded element)



Columns 8 –9: Base and Change loading of the element considering the Project at maximum output.

For the analyses "Normal Condition" or "continuous loading" is defined as all facilities normally in-service. "Post-Contingency" is defined as a single contingency (N-1), i.e., one line or transformer out of service.

Although the following tables show the facility loadings for the full output at 1800 MW, the FCITC indicates at what level those violations may occur. Therefore, the FCITC results are applicable to the Phase 1 Project output of 1200 MW as well.

The results are first presented for the transactions simulated by increasing Arizona load, followed by the transaction simulated by reducing Arizona generation. The results of both analyses must be examined together to identify which violations are attributable (all or part) to increase in load. Violations occurring as a result of an increase in load should be addressed via regional utility planning.

# Alts 1 & 3: Project at 1200 or 1800 MW w/o Silverking

The system was first examined with all facilities in service.

# **Normal Condition Summary**

## **ARIZONA LOAD INCREASE (ALTS 1A AND 3A)** NORMAL (PRE-CONTINGENCY) SUMMARY

Project Full Out	put : 1800 MW				Rating	AC Pov	ver Flow
FCITC To		Overloaded Element	Area	Contingency	N/E	% of N Rating	
FCIIC	Тр				(MVA)	Base	Chg
273	Х	Whitetnk To Whitetnk 230/ 69kv	ΑZ	No Outage	280/349	100%	111%
1255	Χ	Corbell To Corbelrs 230/ 69kv #2	ΑZ	No Outage	302	94%	107%
1482	X	Corbell To Corbelrs 230/ 69kv #3	ΑZ	No Outage	309	93%	105%
1729	L	Sag.West To Ed-5 115kv	ΑZ	No Outage	120	58%	102%

# ARIZONA GENERATION REDUCTION (ALTS 1B AND 3B) NORMAL (PRE-CONTINGENCY) SUMMARY

Project Full Out	put : 1800 MW				Rating	AC Pov	ver Flow
FCITC	To	Overloaded Element	Area	Contingency	N/E	% of N	Rating
FOITO	- 1Р				(MVA)	Base	Chg
0	X	Whitetnk To Whitetnk 230/ 69kv	ΑZ	No Outage	280/349	100%	100%

The study indicates that under normal condition, integration of the Project results in no new loading violations (not attributable to load growth) for either a 1200 or an 1800 MW Project output.

# **Post Contingency Summary**

#### ARIZONA LOAD INCREASE (ALTS 1A AND 3A)

#### **POST-CONTINGENCY SUMMARY**

roject Full Outpu		- Overloaded Element	Area	Contingency	Rating N/E		wer Flow
FCITC	Тр			• •	(MVA)	Base	Chg
-1366	L	Santan To Thundrst 230kv1	ΑZ	Silverkg To Silverkg 500/100kv	363/438	105%	116%
0	L	Avra To Marana 115kv1	ΑZ	Bicknell To Bicknell 230/115kv	57	108%	123%
1033	L	Sag.West To Ed-5 115kv <sup>2</sup>	ΑZ	Coronado To Silverkg 500kv	120	73%	123%
1129	L	Sag.East To Red Rock 115kv2	ΑZ	Coronado To Silverkg 500kv	120	72%	118%
1161	X	Westwing To Ww.3wp 345/100kv	ΑZ	Saguaro To Toltec 500kv	600	21%	152%
1218	Χ	Corbell To Corbelrs 230/ 69kv #29	ΑZ	Coronado To Silverkg 500kv	302	94%	107%
1271	L	Ed-5 To Ed-4 115kv <sup>2</sup>	ΑZ	Coronado To Silverkg 500kv	120	70%	118%
1299	Χ	Cholla To Cholla 500/345kv²	ΑZ	Coronado To Silverkg 500kv	500	74%	121%
1352	Χ	Cholla To Cholla 500/345kv #22	ΑZ	Coronado To Silverkg 500kv	500	73%	120%
1379	Χ	Tortolit To Tortolit 500/138kv <sup>2</sup>	ΑZ	South To Toltc345 345kv	600/672	67%	112%
1482	Χ	Corbell To Corbelrs 230/ 69kv #3	ΑZ	Coronado To Silverkg 500kv	309	93%	106%
1500	L	Vlyfarms To Coolidge 115kv <sup>2</sup>	ΑZ	Coronado To Silverkg 500kv	80	61%	112%
1562	L	Coolidge To Ed-2 115kv <sup>2</sup>	ΑZ	Coronado To Silverkg 500kv	120	62%	116%
1615	L	Westwing To Toltc345 345kv4	ΑZ	Saguaro To Toltec 500kv	672/806	16%	115%
1692	L	Westwing To Aguafria 230kv <sup>3</sup>	ΑZ	Saguaro To Toltec 500kv	526	87%	103%
1750	L	South To Toltc345 345kv4	ΑZ	Saguaro To Toltec 500kv	672/806	9%	110%
1846	L	Sag.East To Oracle 115kv	ΑZ	Sag.West To Snmanuel 115kv	120	83%	107%
1875	L	Picachow To Red Rock 115kv <sup>3</sup>	ΑZ	Coronado To Silverkg 500kv	120/132	61%	102%
2000	L	Ed-2 To Brady 115kv <sup>3</sup>	ΑZ	Coronado To Silverkg 500kv	120	58%	103%
2400	L	Marana To Maranatp 115kv <sup>3</sup>	ΑZ	Bicknell To Bicknell 230/115kv	80	91%	104%
3000	L	Haydenaz To Apache 115kv5	ΑZ	Buterfld To Apache 230kv	99	103%	115%
3450	L	Haydenaz To Apache 115kv	ΑZ	Coronado To Silverkg 500kv	99	85%	105%
		•	AZ	Saguaro To Tortolit 500kv		······································	div

- Pre-existing violation. Overload was not present in generation reduction transaction simulation.
- 2 Higher FCITC limit in generation reduction transaction simulation.
- 3 Overload was not present in generation reduction transaction simulation. Assumed attributable to load growth.
- 4 Construction of facility, a double bundled 954 ACSR, indicates that thermal capability of the line may be considerably higher than the rating identified. Rating may be based on contractual path rating.
- 5 Pre-existing voltage problem

# ARIZONA GENERATION REDUCTION (ALTS 1B AND 3B)

#### **POST-CONTINGENCY SUMMARY**

Project Full Outpu	ut : 1800 MW	Overloaded Element	Are	Continuous	Rating N/E		wer Flow Rating
FCITC	Тр	Overloaded Element	a	Contingency	(MVA)	Base	Chg
1131	Х	Westwing To Ww.3wp 345/100kv1	ΑZ	Saguaro To Toltec 500kv	600	21%	157%
1213	L	Sag.West To Ed-5 115kv	ΑZ	Coronado To Silverkg 500kv	120	73%	112%
1232	Χ	Westwing To Ww.3wp 500/100kv	ΑZ	Saguaro To Toltec 500kv	600	21%	163%
1340	L	Sag.East To Red Rock 115kv	ΑZ	Coronado To Silverkg 500kv	120	72%	108%
1434	Χ	Cholla To Cholla 500/345kv	ΑZ	Coronado To Silverkg 500kv	500	74%	114%
1473	L	Ed-5 To Ed-4 115kv	ΑZ	Coronado To Silverkg 500kv	120	70%	108%
1487	Χ	Cholla To Cholla 500/345kv #2	ΑZ	Coronado To Silverkg 500kv	500	73%	112%
1573	L	Westwing To Toltc345 345kv	ΑZ	Saguaro To Toltec 500kv	672/806	16%	117%
1690	L	Coolidge To Ed-2 115kv	ΑZ	Coronado To Silverkg 500kv	120	62%	108%
1742	L	Vlyfarms To Coolidge 115kv	ΑZ	Coronado To Silverkg 500kv	80	61%	102%
1769	Χ	Tortolit To Tortolit 500/138kv	ΑZ	South To Toltc345 345kv	600/672	67%	101%
1798	L	South To Toltc345 345kv	ΑZ	Saguaro To Toltec 500kv	672/806	9%	106%
2323	L	Sag.East To Oracle 115kv	ΑZ	Sag.West To Snmanuel 115kv	120	83%	103%
	L	Haydenaz To Apache 115 kv²	ΑZ	Buterfld To Apache 230kv	99	103%	104%

- 1 Internal transformer winding. No emergency rating provided
- 2 Pre-existing violation

The post contingency results for Alternative 1 and 3 show that the first new violation occurs at the 1033 MW Project output level assuming a transaction simulated by increasing load. However, this same contingency does not occur until a Project output level of 1213 MW when scaling back generation. It is therefore, expected that the first potentially limiting contingency would be the Westwing transformer occurring at a Project output level of approximately 1150 MW. It is noted however, that for this facility only one rating is provided. In that regard, it is not unusual for a transformer to have an emergency rating up to 25% higher than the normal rating. Assuming that an emergency rating does exist, it is expected that the Project can deliver approximately 1200 MW to the grid prior to a violation occurring, based on the generator reduction case loadings on the Sag West to Ed-5 and Sag. East to Red Rock 115 kV lines.

To integrate the 1800 MW Project, regional 115 kV upgrades, system modification or implementation of operating schemes could be necessary. While the loading on the Cholla transformer is well within 125% of normal rating, loading on the Westwing 500/345 kV transformer may require a remedial action scheme or other system modification. The "announced" second Westwing – South 345 kV line included in TEP's 10-year plan would presumably alleviate this violation.

The following tables identify facilities on which integration of the Project alleviated preexisting loading violations.

#### ARIZONA LOAD INCREASE (ALTS 1B AND 3B)

#### **VIOLATIONS ALLEVIATED**

Тр	Overloaded Element	Area			AC Power Flow % of E Rating		
				(MVA)	Base	Chg	
L	Apache To Buterfld 230kv	ΑZ	Vail To Greenlee 345kv	268	106%	93%	
Χ	Bicknell To Bicknell 230/345kv	ΑZ	Red Tail To Doscondo 230kv	150/193	103%	90%	
L	Buterfld To Pantano 230kv	ΑZ	Red Tail To Doscondo 230kv	268	102%	95%	

#### **ARIZONA GENERATION REDUCTION (ALTS 1B AND 3B)**

#### **VIOLATIONS ALLEVIATED**

Тр	Overloaded Element	Area	Contingency	Rating N/E	AC Pow	
				(MVA)	Base	Chg
L	Apache To Buterfld 230kv	ΑZ	Vail To Greenlee 345kv	268	106%	81%
Χ	Bicknell To Bicknell 230/345kv	ΑZ	Red Tail To Doscondo 230kv	150/193	103%	83%
L	Buterfid To Pantano 230kv	ΑZ	Red Tail To Doscondo 230kv	268	102%	86%
L	Avra To Marana 115kv	ΑZ	Saguaro To Tortolit 500kv	57	104%	95%
L	Santan To Thundrst 230ky	ΑZ	Silverkg To Silverkg 500/100kv	363/438	105%	98%

# Alts 2 & 4: Project at 1200 or 1800 MW w/Silverking

The system was first examined with all facilities in service.

# **Normal Condition Summary**

#### ARIZONA LOAD INCREASE (ALTS 2A AND 4A)

#### NORMAL (PRE-CONTINGENCY) SUMMARY

roject Full Out	put : 1800 MW	-			Rating	AC Power Flow		
FCITC	Тр	Overloaded Element	Area	Contingency	N/E	% of N	Rating	
	٠,		(MVA)		(MVA)	Base	Chg	
273	Х	Whitetnk To Whitetnk 230/ 69kv	AZ	No Outage	280/349	100%	111%	
1255	X	Corbell To Corbelrs 230/ 69kv #2	ΑZ	No Outage	302	94%	107%	
1482	Х	Corbell To Corbelrs 230/ 69kv #3	ΑZ	No Outage	309	93%	105%	
1605	L	Glendale To Aguafria 230kv	ΑZ	No Outage	457/569	85%	104%	
1895	L	Pnpkaps To Pinpk 230kv	ΑZ	No Outage	637/700	91%	103%	
1950	L	Meadowbk To Sunyslop 230kv	ΑZ	No Outage	325/490	97%	108%	
2074	X	Ocotillo To Ocotillo 230/ 69kv #E	ΑZ	No Outage	296	84%	100%	

#### **ARIZONA GENERATION REDUCTION (ALTS 2B AND 4B)**

#### NORMAL (PRE-CONTINGENCY) SUMMARY

Project Full Out	put : 1800 MV	<u>Y</u>			Rating	AC Pov	ver Flow
FCITC	Τp	Overloaded Element	Area	Contingency	N/E	% of N	Rating
-CitC	ıp				(MVA)	Base	Chg
0	X	Whitetnk To Whitetnk 230/ 69kv	AZ	No Outage	280/349	100%	100%

As with Alternatives 1 and 3 (without the Silverking connection), the study indicates that under normal condition, integration of the Project results in no new loading violations (not attributable to load growth) for either a 1200 or an 1800 MW Project output.

# **Post Contingency Summary**

#### ARIZONA LOAD INCREASE (ALTS 2A AND 4A)

#### **POST-CONTINGENCY SUMMARY**

Project Full Output : 1800 MW		Overloaded Element		Contingency	Rating N/E	AC Power Flow % of E Rating	
FCITC	Тр	Overloaded Liement	Area	Continuency	(MVA)		
-1550	L	Santan To Thundrst 230kv1	ΑZ	Silverka To Silverka 500/100kv	363/438	114%	<b>Chg</b> 135%
0	L	Avra To Marana 115kv1	ΑZ	Bicknell To Bicknell 230/115kv	57	107%	122%
800	L	Avra To Marana 115kv	ΑZ	Buterfld To Apache 230kv	57	93%	111%
1335	Χ	Westwing To Ww.3wp 345/100kv	ΑZ	Saguaro To Toltec 500kv	600	26%	145%
1336	Χ	Westwing To Ww.3wp 500/100kv	ΑZ	Saguaro To Toltec 500kv	600	26%	150%
1602	L	Ctryclub To Meadowbk 230kv	ΑZ	Saguaro To Toltec 500kv	518	87%	107%
1654	L	South To Toltc345 345kv	ΑZ	Saguaro To Toltec 500kv	672/806	14%	115%
1720	L	Westwing To Toltc345 345kv	ΑZ	Saguaro To Toltec 500kv	672/806	19%	109%
1800	Χ	Tortolit To Tortolit 500/138kv	ΑZ	South To Toltc345 345kv	600/672	59%	101%
1800	L	Westwing To Aguafria 230kv	ΑZ	Saguaro To Toltec 500kv	526	86%	102%
2400	L	Marana To Maranatp 115kv	ΑZ	Bicknell To Bicknell 230/115kv	80	90%	103%
7800	L	Haydenaz To Apache 115kv	ΑZ	Buterfld To Apache 230kv	99	99%	104%
			AZ	Saguaro To Tortolit 500kv			div

#### **ARIZONA GENERATION REDUCTION (ALTS 2B AND 4B)**

#### **POST-CONTINGENCY SUMMARY**

Project Full O MV	•	Overloaded Element	Area	Contingency	Rating N/E (MVA)		ver Flow
FCITC	Тр	Overloaded Element	Alta	Contingency		Base	Chg
-10145	L	Santan To Thundrst 230kv1	ΑZ	Silverkg To Silverkg 500/100kv	363/438	114%	117%
0	L	Avra To Marana 115kv1	ΑZ	Bicknell To Bicknell 230/115kv	57	107%	107%
1304	Χ	Westwing To Ww.3wp 345/100kv <sup>2</sup>	ΑZ	Saguaro To Toltec 500kv	600	26%	150%
1305	Χ	Westwing To Ww.3wp 500/100kv	ΑZ	Saguaro To Toltec 500kv	600	26%	155%
1680	L	Westwing To Toltc345 345kv3	ΑZ	Saguaro To Toltec 500kv	672/806	19%	112%
1702	L	South To Toltc345 345kv3	ΑZ	Saguaro To Toltec 500kv	672/806	14%	111%
			ΑZ	Saguaro To Tortolit 500kv			div

- 1 Pre-existing violation worsen primarily due to load growth.
- 2 Internal transformer winding. No emergency rating provided
- 3 Construction of facility, a double bundled 954 ACSR, indicates that thermal capability of the line may be considerably higher than the rating identified. Rating may be based on contractual path rating.

With the Silverking interconnection, the first new loading violation occurs at a Project output level of 1304 MW. It is noted that the Avra to Marana 115 kV line was a pre-existing violation, the level of which did not change for the generation reduction transaction.

Loading on the Westwing 500/345 kV transformer may require a remedial action scheme or other system modification. The "announced" second Westwing - South 345 kV line included in TEP's 10-year plan would presumably alleviate this violation.

A loading violation occurs on the Westwing to Toltec to South lines at approximately 1700 MW Project output level, the emergency rating of this line appears limited by path rating as opposed to thermal capability of a double bundled 954 ACSR constructed line.

The following tables identify facilities on which integration of the Project alleviated preexisting loading violations.

# ARIZONA LOAD INCREASE (ALTS 2A AND 4A)

#### **VIOLATIONS ALLEVIATED**

Тр	Overloaded Element	Area	Contingency	Rating N/E		rer Flow Rating
				(MVA)	Base	Chg
L	Cholla To Silverkg 500kv	ΑZ	Coronado To Silverkg 500kv	889/1332	100%	88%
L	Apache To Buterfld 230kv	ΑZ	Vail To Greenlee 345kv	268	107%	99%
Χ	Bicknell To Bicknell 230/345kv	ΑZ	Red Tail To Doscondo 230kv	150/193	101%	94%
L	Buterfld To Pantano 230kv	ΑZ	Red Tail To Doscondo 230kv	268	103%	98%

#### **ARIZONA GENERATION REDUCTION (ALTS 2B AND 4B)**

#### **VIOLATIONS ALLEVIATED**

Тр	Overloaded Element	Агеа	Contingency	Rating N/E		rer Flow Rating
				(MVA)	Base	Chg
L	Cholla To Silverkg 500kv	ΑZ	Coronado To Silverkg 500kv	889/1332	100%	78%
L	Apache To Buterfld 230kv	ΑZ	Vail To Greenlee 345kv	268	107%	87%
L	Buterfld To Pantano 230kv	ΑZ	Red Tail To Doscondo 230kv	268	103%	89%
Χ	Bicknell To Bicknell 230/345kv	ΑZ	Red Tail To Doscondo 230kv	150/193	101%	87%

# **Facility Flow Summary**

A summary of flows on regional facilities is provided below.

-								Flows Sylves Colected Feeilities	Fooilition				
i	ľ				١		NOWS OF	naiseilea	racilines				
Element	_	Base	<b>≱</b> 1≱	<b>≱</b> 18	Base .	A# 24	AF 28	Base	At 34	Alt 3B	Base	₩.	At 48
	Rating		Load	Gen Scale	w/ Silverking	Load Scale w/ Silverking	Gen Scale w/ Silverking	w/ Santan	Load Scale w/ Santan	Gen Scale w/ Santan	w/ Santan & Silverking	Load Scale w/ Santan & Silverking	Gen Scale w/ Santan & Silverking
Silverking/EV Area Facilities		<b>'</b>	1200MW	1200MW		1200MW	1200MW		1800MW	1800MW		1800MW	1800MW
Cholla – Saquaro 500 kV line	2018	571	255	88	,		,	99	8	ψ	,	1	,
Cholla - Silverking 500 kV line	2018	•	ı		<b>100</b>	296	305	1			1038	88	662
Silverking - Saguaro 500 kV line	2018		,	•	364	-175	-507	•	,		372	427	477
Coronado – Silverking 500 kV line	1732	735	961	823	476	456	426	715	66	855	467	437	395
Browning - Silverking 500 kV line	1732/2217	-372	458	<del>4</del> 5	-722	-1051	-1026	-367	469	<del>_</del> 4	<del>869</del>	-1186	-1152
Kyrene - Browning 500 kV line	1732/2217	117	22	₽	-172	450	438	×	\$	88	-250	-614	929
Kyrene 500/230 kV Xfmr #6	1233	669	743	883	781	877	811	902	766	674	778	919	821
Kyrene 500/230 kV Xfmr #7	1233	93	899	613	902	<b>2</b> 5	33	830	989	905	702	827	741
Jojoba – Kyrene 500 kV line	1732/2217	1454	1494	1343	1322	1254	1111	1362	1417	1196	1236	1137	676
Project Ties													
Tottec - Saguaro 500 kV line	2598	0	642	140	0	961	852	0	1025	1025	0	1277	1266
Westwing - Tottec 345 kv	672/806	¥	-279	-295	ΑΝ	-100	-123	Α	429	<del>4</del> 55	Ϋ́	-225	-257
Westwing - South 345 kV line	672/806	62	•		124	•		ಜ		,	115	•	•
Toftec - South 345 kV	908/7	ΑN	272	<b>3</b> 90	Ϋ́	239	225	Α	338	315	Υ	238	9/2
Tucson Delivery Ties												!	
Saguaro – Tortolit 500 kV line	908/2/90	417	222	88	352	481	<del>4</del>	420	288	<del>5</del> 5	357	5 <del>4</del> 6	492
Westwing - South 345 kV line	672/806	£,		•	124		•	ಜ		•	115	•	1
Tottec - South 345 kV line	672/806	¥	272	<b>3</b> 80	NA	538	83	NA	339	315	NA	88	276
Greenlee - Vail 345 kV line	896/1210	321	221	218	33	<b>2</b> 20	526	323	225	176	332	270	219
Springerville - Vail 345 kV line	908/999	424	375	¥	<b>62</b>	411	376	425	326	305	<del>4</del>	386	345

In addition to the impacts identified previously, integration of the Project has several positive impact on system flows. For example, integration of the Project reduces flow on the Kyrene transformers. Additionally, integration of the Project appears to better balance delivery of power to the Tucson system. It increases the flow into Tucson at both Tortolita and South potentially providing more flexibility in regards to future system modifications.

# Appendix A CONTINGENCY LIST

# **Contingency List**

C- 1	Line	16101	GREENLEE	345kV	to	11080	HIDALGO	345kV	Ckt 1
C- 2	Line	16101	GREENLEE	345kV	to	16104	SPRINGR	345kV	Ckt 1
C- 3	Line	16101	GREENLEE	345kV	to	17010	GREEN-AE	345kV	Ckt 1
C- 4	Line	16105	VAIL	345kV	to	16103	SOUTH	345kV	Ckt 1
C- 5	Line	16105	VAIL	345kV	to	17005	BICKNELL	345kV	Ckt 1
C- 6	Transformer	16105	VAIL	345kV	to	16308	VAIL.3WP	100kV	Ckt 1
C- 7	Line	11080	HIDALGO	345kV	to	11093	LUNA	345kV	Ckt 1
C- 8	Line	16103	SOUTH	345kV	to	93001	TOLTC345	345kV	Ckt 1
C- 9	Line	16104	SPRINGR	345kV	to	16102	MCKINLEY	345kV	Ckt 1
C- 10	Line	16104	SPRINGR	345kV	to	16102	MCKINLEY	345kV	Ckt 2
C- 11	Line	16104	SPRINGR	345kV	to	11093	LUNA	345kV	Ckt 1
C- 12	Line	16104	SPRINGR	345kV	to	16100	CORONADO	345kV	Ckt 1
C- 13	Transformer	17005	BICKNELL	345kV	to	17004	BICKNELL	230kV	Ckt 1
C- 14	Transformer	17010	GREEN-AE	345kV	to	17009	GREEN-AE	230kV	Ckt 1
C- 15	Transformer	17010	GREEN-AE	345kV	to	17009	GREEN-AE	230kV	Ckt 2
C- 16	Transformer	16103	SOUTH	345kV	to	16306	SO.3WP2	100kV	Ckt 1
C- 17	Transformer	16308	VAIL.3WP	100kV	to	16220	VAIL	138kV	Ckt 1
C- 18	Transformer	16100	CORONADO	345kV	to	15001	CORONADO	500kV	Ckt 1
C- 19	Line	16102	MCKINLEY	345kV	to	10292	SAN_JUAN	345kV	Ckt 1
C- 20	Line	16102	MCKINLEY	345kV	to	10292	SAN_JUAN	345kV	Ckt 2
C- 21	Line	93001	TOLTC345	345kV	to	16107	WESTWING	345kV	Ckt 1
C- 22	Line	17004	BICKNELL	230kV	to	17102	SAHUARIT	230kV	Ckt 1
C- 23	Line	17009	GREEN-AE	230kV	to	17014	MORENCI	230kV	Ckt 1
C- 24	Transformer	17004	BICKNELL	230kV	to	17006	BICKNELL	115kV	Ckt 1
C- 25	Line	16220	VAIL	138kV	to	16204	IRVNGTN	138kV	Ckt 1
C- 26	Line	16220	VAIL	138kV	to	16211	ROBERTS	138kV	Ckt 1
C- 27	Line	16220	VAIL	138kV	to	16213	S.TRAIL	138kV	Ckt 1
C- 28	Line	16220	VAIL	138kV	to	16222	LITTLE	138kV	Ckt 1
C- 29	Line	16220	VAIL	138kV	to	16223	LOSREALS	138kV	Ckt 1
C- 30	Transformer	16306	SO.3WP2	100kV	to	16216	SOUTH	138kV	Ckt 1
C- 31	Line	15001	CORONADO	500kV	to	14000	CHOLLA	500kV	Ckt 1
C- 32	Line	15001	CORONADO	500kV	to	15041	SILVERKG	500kV	Ckt 1
C- 33	Line	17014	MORENCI	230kV	to	17011	HACKBRRY	230kV	Ckt 1
C- 34	Line	17016	PANTANO	230kV	to	17007	BUTERFLD	230kV	Ckt 1
C- 35	Line	17016	PANTANO	230kV	to	17102	SAHUARIT	230kV	Ckt 1
C- 36	Line	16202	E. LOOP	138kV	to	16208	NE.LOOP	138kV	Ckt 1
C- 37	Line	16202	E. LOOP	138kV	to	16211	ROBERTS	138kV	Ckt 1
C- 38	Line	16202	E. LOOP	138kV	to	16224	R.BILLS	138kV	Ckt 1
C- 39	Line	16202	E. LOOP	138kV	to	16213	S.TRAIL	138kV	Ckt 1
C- 40	Line	16202	E. LOOP	138kV	to	16215	SNYDER	138kV	Ckt 1
C- 41	Line	16204	IRVNGTN	138kV	to	16201	DREXEL	138kV	Ckt 1
C- 42	Line	16204	IRVNGTN	138kV		16216	SOUTH	138kV	Ckt 1
C- 43	Line	16204	IRVNGTN	138kV	to	16218	TUCSON	138kV	Ckt 1



C- 44	Line	16204	IRVNGTN	138kV	to	16222	LITTLE	138kV	Ckt 1	
C- 45	Line	16204	IRVNGTN	138kV			SN.CRUZ	138kV	Ckt 1	
C- 46	Line	16216	SOUTH	138kV	to	16206	MIDVALE	138kV	Ckt 1	
C- 47	Line	16223	LOSREALS	138kV	to	16224	R.BILLS	138kV	Ckt 1	
C- 48	Line	17006	BICKNELL	115kV	to	17022	THREEPNT	115kV	Ckt 1	
C- 49	Line	14004	SAGUARO	500kV	to	16000	TORTOLIT	500kV	Ckt 1	
C- 50	Transformer	14004	SAGUARO	500kV	to	14356	SAG.EAST	115kV	Ckt 1	
C- 51	Transformer	14004	SAGUARO	500kV	to	14357	SAG.WEST	115kV	Ckt 1	
C- 52	Transformer	15041	SILVERKG	500kV	to	15042	SILVERKG	100kV	Ckt 1	
C- 53	Transformer	14101	FOURCORN	345kV	to	14001	FOURCORN	500kV	Ckt 1	
C- 54	Line	17007	BUTERFLD	230kV	to	17002	APACHE	230kV	Ckt 1	
C- 55	Line	17008	DOSCONDO	230kV	to	17011	HACKBRRY	230kV	Ckt 1	
C- 56	Line	16208	NE.LOOP	138kV	to	16210	RILLITO	138kV	Ckt 1	
C- 57	Line	16208	NE.LOOP	138kV	to	16215	SNYDER	138kV	Ckt 1	
C- 58	Line	16214	SN.CRUZ	138kV	to	16200	DMP	138kV	Ckt 1	
C- 59	Line	16218	TUCSON	138kV	to	16221	WESTINA	138kV	Ckt 1	
C- 60	Line	10206	MIMBRES	115kV	to	12014	CABALLOT	115kV	Ckt 1	
C- 61	Line	17022	THREEPNT	115kV	to	17003	AVRA	115kV	Ckt 1	
C- 62	Transformer	16309	WW.3WP	100kV	to	14005	WESTWING	500kV	Ckt 1	
C- 63	Line	17002	APACHE	230kV	to	17018	RED TAIL	230kV	Ckt 1	
C- 64	Transformer	17002	APACHE	230kV	to	17001	APACHE	115kV	Ckt 1	
C- 65	Transformer	17002	APACHE	230kV	to	17001	APACHE	115kV	Ckt 2	
C- 66	Line	16200	DMP	138kV	to	16207	N. LOOP	138kV	Ckt 1	
C- 67	Line	16210	RILLITO	138kV	to	16207	N. LOOP	138kV	Ckt 1	
C- 68	Line	16210	RILLITO	138kV	to	16205	LACANADA	138kV	Ckt 1	
C- 69	Line	16221	WESTINA	138kV	to	16207	N. LOOP	138kV	Ckt 1	
C- 70	Transformer	14356	SAG.EAST	115kV	to	14225	SAGUARO	230kV	Ckt 1	
C- 71	Line	12014	CABALLOT	115kV	to	12041	HOT_SPRG	115kV	Ckt 1	
C- 72	Line	12059	PICACHO	115kV	to	12028	EL_BUTTE	115kV	Ckt 1	
C- 73	Line	14356	SAG.EAST	115kV	to	14357	SAG.WEST	115kV	Ckt 1	
C- 74	Line	14356	SAG.EAST	115kV	to	19057	ORACLE	115kV	Ckt 1	
C- 75	Line	14356	SAG.EAST	115kV	to	17013	MARANATP	115kV	Ckt 1	
C- 76	Line	14357	SAG.WEST	115kV	to	14358	SNMANUEL	115kV	Ckt 1	
C- 77	Line	14357	SAG.WEST	115kV	to	19048	EMPIRE	115kV	Ckt 1	
C- 78			AVRA	115kV	to	17012	MARANA	115kV	Ckt 1	
C- 79	Transformer	15042	SILVERKG	100kV	to	15215	SILVERKG	230kV	Ckt 1	
C- 80	Line	14004	SAGUARO	500kV	to	93000	TOLTEC	500kV	Ckt 1	
C- 81	Line	16105	VAIL	345kV	to	16101	GREENLEE	345kV	Ckt 1	
C- 82	Line	16106	VAIL2	345kV	to	16104	SPRINGR	345kV	Ckt 1	
C- 83			RED TAIL	230kV			DOSCONDO			
C- 84			CHOLLA	500kV			SAGUARO			Alt 1 & 3 Only
C- 84		14000	CHOLLA	500kV	to	15041	SILVERKG	500kV	Ckt 1	Alt 2 & 4 Only
C- 85	Line	15041	SILVERKG	500kV	to	14004	SAGUARO	500kV	Ckt 1	Alt 2 & 4 Only